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The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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The Solid State

At first sight an International Conference on Physics would appear to hold little of immediate interest to the foundry industry, but the discussion, held at the Royal Society last week, upon the nature and properties of the solid state, offers much food for thought to all concerned with the working and employment of metals. The conference, a joint meeting of the International Union of Pure and Applied Physics and the Physical Society, attracted a number of distinguished physicists, among whom the names of Bragg, Andrade, Joffé, Taylor, Gough and Desch are familiar to all metallurgists. Modern work on the solid state is concerned with a region intermediate between that revealed by microscopic methods and the field of X-ray crystal analysis, and the major problems involved are those of the phenomenon of cohesion and of the deformation and rupture of metals. It is one of the most mysterious of Nature's problems that whilst the intrinsic cohesion of a metal is known to be extremely high, as exemplified by the enormous strength of finely-spun threads, the actual mechanical strength exhibited in testing and in engineering service is by comparison very low. A number of explanations have been advanced from time to time to account for this discrepancy, chiefly based upon the existence of minute discontinuities which act as regions of stress concentration, but it cannot be said that any unanimity of opinion has yet been achieved among physicists.

The foundryman is concerned primarily with the transition of metals from the liquid to the solid state, but even after solidification is complete his difficulties and perplexities are not overcome. The mechanism of graphitisation, the still mysterious "seasoning" effect in castings, heat-treatment and age-hardening technique, are all bound up with the inner mechanism of the solid state. The influence of the grain boundary upon strength properties also plays an important part in any metal-working industry, and it is only by the patient and painstaking investigation of this fundamental structure of metals that any light will be thrown upon this problem.

But as we mentioned above, major interest centres around the mechanism of deformation and rupture in metals, and the related phenomenon of fatigue. It is, therefore, very pleasant to find the physicists leaving for the time being their indeterministic discussions on radioactivity, atomic structure and the quantum theory and turning to the rather more macroscopic field of the solid state. Prof. Joffé, Director of the Physical Technical Institute in Leningrad, delivered two Papers dealing respectively with "The Cause of the Low Value of Mechanical Strength" and "The Mechanism of Brittle Rupture." Dr. Orowan presented a Paper on "The Rupture of Plastic Crystals," and Dr. Schmid a Paper on "Plastic Deformation by Slip," whilst our own workers, Andrade, Taylor, Gough and Desch, took part in the interesting discussion which followed. The indications are that the methods adopted in this sphere will lead to an advance in metallurgical science roughly parallel to the enormous developments made possible by the introduction and exploitation of the X-ray technique fifteen years ago.

Expert Witnesses.—I

A number of eminent and responsible men in the foundry industry have at one time or another found themselves in the position of being in the category of expert witnesses, of being employed by one side or the other in a legal action in which expert testimony is required. This term there is to be a very marked change in legal procedure relating to expert witnesses which may very materially reduce those guineas accruing to a few consultants and others when such cases arise. It is said that there are, all told, somethink like a thousand men who gain incomes in this way.

Few Press comments on this change have failed to quote, wholly or in part, the famous remark of Lord Bramwell, that there were four degrees of liar, "liars, damned liars, expert witnesses, and my brother Frederick." And the dog, having been given a bad name, may as well be hung, for it is no use pretending that the expert witness is well thought of. Experts generally, in fact, are somewhat distrusted in England, and that they differ in their views is notorious. Even when there is little room for difference of opinion, they are human and fallible, like the rest of us. We do, however, take strong exception to the attitude often adopted towards expert witnesses in legal cases. As long as they are retained by one side, then it is only natural that they should do their best for that side, and in this respect they are in exactly the same position as a barrister, who is employed to and allowed to do the best for his client. Public opinion encourages him to do so. However, the expert will feel much more comfortable under the new regulations.

Very briefly, these are that, in non-jury actions, the Judge, with the consent of both parties, may appoint one expert to report on all the technical issues involved. Cross-examination may be carried out in private instead of in court. We are unaware whether such procedure applies to arbitration cases, but it is calculated to restore status to the expert witness and hence will be welcomed by experts, even if it means fewer fees. Furthermore, it will certainly discourage the self-constituted expert.

C

Correspondence

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Names and Numbers

To the Editor of The Foundry Trade Journal.

Sir,—The practice of advertising a product under a high-sounding brand name, now so well established in the household commodity trades, appears to be developing to a considerable extent in the metallurgical industries. Day by day alloys and castings are put on the market under all manner of fanciful titles, concocted from the name of the firm or of one or other of the constituent elements, and often embellished with a mystic number. This regrettable but now apparently unavoidable practice—which probably began in its present form with the introduction of Duralumin, although for many years before this the Sheffield tool-steel makers had made a habit of selling their products under brand names—is obviously intended to influence the buyer in this choice. But is the buyer of to-day susceptible to the hypnotic suggestions of Hogitoff, Skintite, O.K. 17 or N.B.G. 5? The tendency in the purchasing of engineering material is more and more in the direction of buying to specification, either standard or individual, and the buyer, even if he be of a gullible nature, is not even in a position to flirt with proprietary lines. The brand name may serve a valuable purpose as a guarantee and reminder in the case of goods sold over the counter to the general public, but the products of modern metallurgical industry hardly fall within the same category of acceptance requirements as toilet soap, silk stockings and baked beans.

This practice is reminiscent of the primitive delight taken by the savage and the child in the magic effect of names. To this type of mind the bond between the name and the object does not seem incidental but real and substantial; to name anything is to raise it from the status of mere physical occurrence to that of a distinct and dignified object. The words of the name impress not merely as symbols but as independent entities, and by dulling the critical faculties exert a powerful influence upon the simple mind. The indiscriminate christening of common or garden alloys or materials is therefore hardly complimentary to the intelligence of the consumer, and although the policy doubtless meets with a measure of success for the time being, if carried to excess it cannot but end in the disillusion of the engineer and the buyer.

Credit is certainly due for marked improvements or developments made by individual firms, and it is obviously tempting to focus selling points upon a distinctive title. Furthermore, the non-ferrous alloys, for example, cannot be described in quite the same succinct manner that is employed for the plain and alloy steels, and a certain amount of extension of the nomenclature is both necessary and desirable. But even here a particular alloy may be known under five or six different names—according to the foundry from which it emanates. It is indeed too much to hope for the full revision of our metallurgical nomenclature, but in the meantime it is at least desirable that the number of additions should be kept to a minimum. Major developments and departures from the normal practice must certainly be earmarked in the appropriate manner, but there is little to be said for the practice of bestowing an imposing title upon what is nothing more than a good-class but perfectly ordinary cast iron, alloy steel or non-ferrous alloy. The best and most easily-remembered advertisement is surely a general reputation for quality, integrity and enterprise attaching to the name of the firm itself.

In conformity with the sentiments expressed herein I enclose my card but remain—Yours, etc., "Nemo."

District Presidents.—No. 6

NEWCASTLE BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

After serving his apprenticeship with Messrs. Robert Stephenson & Company, Forth Banks Works, Newcastle, Mr. F. Robson, President of the Newcastle Branch of the Institute of British Foundrymen, left England for Canada. After about 4½ years' experience in some of the largest foundries there, he returned home and took a position with the Darlington Railway Plant & Foundry Company, which he gave up after a year or two to go to Noble Lund, Limited,

Mr. F. Robson.

Felling-on-Tyne. In 1919 Mr. Robson was appointed foreman moulder at Armstrong Whitworth & Company, Limited, Close Works, Gateshead, where he remained for two years, until he left to take up his present position as foundry manager at F. Turnbull & Company, Heaton Junction, Newcastle.

A New Stop-Watch

We have had the opportunity of personally examining Arnold's Universal stop-watch (though why it is called "Universal" when it carries prominently the name "Stadion" we fail to understand). It is graduated to one-fifth of a second and, in addition to the fly-back mechanism, there is an eliminator attachment conveniently placed at the side of the winder which enables one to stop and start the watch without returning to zero. For sporting events, such as a desire to meet the football crowd's insistence of "Take time off," the utility is obvious, but in the foundry and laboratory its use for correct recording is of paramount importance. For instance, if it were desired to know the working time of a moulding machine during a predetermined period, nothing could be easier. If the period happens to be that of 45 minutes, special provision is made by the three-quartering of the 60-minute dial in red, obviously a gesture to the importance of Association Football as a market for stop-watches. The casing is chromium plated and the glass unbreakable. The watch is sold by Messrs. A. Arnold & Company, of 122, St. John Street, Clerkenwell Road, London, E.C.1. Though in the ordinary way it is against our rule to disclose prices, we think in this case no harm can be done by stating that it costs 25s. and carries a 3-year guarantee.

Random Shots

"Marksman" presents the following letter without comment:—

"Honourable Sir Marksman,—I think you have pretty clear remembrance I made writing to you some months agone to laud and praise the Foundry publication, and it is pleasuring to me once again to scribe you from these foreign spots. How are your healths and of your so honourable Editor and other working colleagues? I am trustworthy you are all enjoying radiant pink of condition and no bones broken. It is the same with me for I can joyfully explain to be in pretty darn good fettle.

* * *

"I am grievous that to this date I cannot make a proceed to U.K. to stamp my feet on your so honourable doormat and knock placidly to your door as if to remark, 'The foreign chap has arrive and wants to audience you.' That would make pretty good thrills on your back spine Hon. Sir, and I venture prediction you are leaping from your chair to emit some loud welcoming shouts with back slappings to me. Mostlywise the English are descript cold and offstandish, but I count firmly you embrace me to your bosom and Hon. Editor too. You will not disappoint foreign chap in this warmhearted matter, no?

* * *

"I trust that in your native British land the commercial tradings are of an uppish tendency and bringing joyful musings to hearts of manufacturialists. I surmise these fellows are blowing heavy clouds of smoke from rich cigars into atmosphere to make fearful pollution of sweet English air, but that is to expect when business trips along merrily. Here in this place I am making acute strivings to trading endeavours and do hard pushings of goods down customers' throats without choking same, you appreciate? I name vigorously my price list to buyer here, but he mostlike affirm swindle or other contempt to rage me. I think in your country not much fighting when striking bargain but here I swiftly plant kick in seat of pants if buyer reluctant. You appreciate?

* * *

"We have goods import here from many lands, but the English stuff is well like and I make stockings of it in my warehouse to tip of roof. This is good invest of cash and I do not tremble about result of adventure, but with product of some races—'no names, no horseplay' as army saying—it is terrible treacherous step in darkness to make me ring hands in future times. If I shall dispose to buyer this poor chattels he come later on at sudden event hell on leather to my aboding place. I make calm receive to show undisturb, but inside is trembling heart. 'Good day, mister,' I shall say him, 'you want buy something?' Then he look me all ends up and likely gnash his jaws to show displeasure. 'You like rotten tomato,' he shout me and I run him my head to the stomach. You do not blame?

* * *

"These are perhaps not very good reports to your ears, Sir Marksman, but I am not making no violence on English terra firma by my journeyings to your land. Otherwise you say, 'Oh my golly if this dirty dog claim me bosom pal on arrival I am in thick or clear soup as per menu.' I shall grin broad at these wordings to understand you spring joke on me, but it is good understanding to me I do all proper comportments to please British people. Otherwise my name shall stink in your land. You appreciate?"

Marksman.

Mr. Frank Thomas Hawkins, of Dudley, proprietor of Messrs. Hawkins & Company, Crown Foundry, Tipton, and a director of the Galvo Company, Limited, Tipton, died last week.

A Note on the History of the Development of Ironfounding in the Sheffield District*

By J. E. Hurst

The remarkable developments which have been made in the ironfounding industry during the comparatively short space of time of the last six or eight years cannot fail to impress even those who are only remotely connected with the industry. Apart from the magnificent progress made in actual foundry technique, metallurgical developments in connection with the material cast iron have produced types which would never have been contemplated ten or fifteen years ago. Cast irons rich in alloy content, in alloy additions of molybdenum, nickel and vanadium are produced regularly nowadays by quite a number of foundries. Alloy cast irons which rely for their properties on heat-treatment by hardening and tempering, nitrogen hardening, precipitation hardening, treatments exactly parallel to those applied to various special steels, are now staple products of the ironfounding industry. These developments, in order of magnitude and industrial importance, almost rival those which have taken place in the steel industry.

The part played by Sheffield in the development of the steel industry is very well known, but it is not nearly so well known, outside the ironfounding industry, that Sheffield and the immediate neighbourhood have played a part of almost equal prominence in the developments which have taken place in connection with cast iron. During recent months, also, the attention of the foundry industry throughout the whole world has been focussed on Sheffield, by reason of the inauguration of the foundry degree course within the Faculty of Metallurgy at the University of Sheffield. Here, again, as in the past, Sheffield has taken a lead, and it is highly probable that the creation of a separate school of foundry metallurgy within the walls of the University will play a part in the future development of this industry, and will rival in importance the already world-famous metallurgical school in the University. The Institute of British Foundrymen, along with the Professor and Dean of the Faculty of Metallurgy, Prof. Andrew, has been the prime mover in the establishment of this foundry school, and the Institute in general, and the Sheffield Branch in particular, takes a special pride in being so closely connected with this development.

In recent foundry history, particularly that of ironfounding, it is evident from even this brief survey, that Sheffield and its environs has not in any way failed to uphold the high standard of metallurgical tradition already established in connection with the alloy-steel industry. The study of the early stages of the development of this industry in this district thus becomes a matter of interest. The historical development of the steel industry in the Sheffield neighbourhood has received considerable attention at the hands of metallurgical historians, but I am not aware that any very great attention has been paid to the separate subject of the development of the ironfounding industry. A mere superficial study of this subject reveals the fact that the Sheffield district has taken a part of no mean order of prominence in this development. My own studies in this direction can still be regarded only as of a superficial character, and the complete history, if it is ever written, will, I am certain, fill a volume. I venture to submit this essay to you as my presidential address, in the hope that it will be a matter of deep local interest to the Sheffield Branch of the Institute, and also that it may have a wider interest as a contribution to the general history of the development of the ironfounding section of the metallurgical industries, and stimulate interest in the further study of this subject, which, to the author's mind, has not yet received the attention it deserves.

Fig. 1. — The Smithy Houses, Thorpe Common, after Renovation in 1928. The Site of the Monks' Forge in 1161.

Ex "Sheffield, Hallamshire," by permission of the Chief Librarian, Sheffield.

Commencement of the Ironfounding Industry in the Sheffield District

Ironfounding as an industry in present times is clearly defined as the industry engaged in the production of castings in the material cast iron. In earlier times the word ironfounding apparently held a broader meaning. The application was applied frequently to ironworking in general, and did not always imply the narrower understanding of the production of castings in cast iron. It is this circumstance as much as any other which makes difficult the study of the early history of the production of castings in cast iron, and to separate such industry from the general mass of ferrous industries, including smelting, refining and forging. As an industrial material, cast iron was later in development than wrought or malleable iron, which was formerly produced direct from the ore in the forge or bloomery hearth. Whatever may have been the state of the art of ironmaking prior to the coming of the Romans, such methods of direct malleable-iron production were firmly established by them in this country as soon as their conquest was secure. The extensive nature of these operations during the Roman occupation may be judged from the fact that the enormous heaps of scoriac and cinders left in the neighbourhood of such "blowing forges" furnished later ironworks with substitutes for ore for many years.

When and where the blast furnace was first introduced is uncertain. It has been believed generally that the art of bringing iron to the melting point in blast furnaces was unknown in this country prior to the fifteenth century, and that it was then brought into England from Germany. Fell* holds the opinion from the examination of slags left by the Romans, that whilst their processes were principally those of the direct reduction in the forge, they also produced iron in the molten state. It is recorded that the Romans were familiar with cast-iron statuary stated to have been introduced about the year A.D. 170 by the Sanian Theodorus. A small Roman statuette, said to be of cast iron, is recorded as having been found in the parish of Battle, Sussex. Few traces of cast-iron castings exist prior to the fourteenth and fifteenth centuries, and the first authentic record of iron castings in England is in connection with the manufacture of cannon at Buxted, in Sussex, in the year 1543, during the reign of Henry VIII. "The question of the date of the introduction of the blast furnaces will probably never be settled, for it appears likely that the blast furnace was not the result of a sudden act of creation, but of slow evolution. All that can be said with certainty is that in the days of Edward III most, if not all, of the iron used was the product of the bloomery or forge, while in the days of Henry VIII by far the greater part was smelted in the furnace and cast into finished articles, or into pigs that were subsequently refined into malleable wrought-iron bars at the forge."

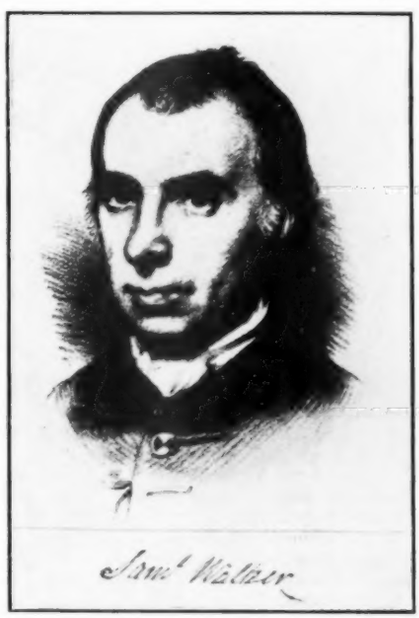

Fig. 2.—Samuel Walker, the Founder of the Walker Enterprise in Grenoside and Rotherham, 1745.

Ex "Historic Notices of Rotherham," Guest; by permission of the Chief Librarian, Sheffield.

Establishment of Monastry Forges

By a charter dated 1161, Richard de Busli, then Lord of the Manor of Kimberworth, near Rotherham, granted a lease to the monks of Kirkstede Abbey, in Lincolnshire, to establish

* Presidential Address to the Sheffield Branch of the Institute of British Foundrymen.

* "The Early Iron Industry of Furness" (Fell).

forges for the working of iron in the vicinity of Kimberworth.* Probably the charter constitutes the earliest written record of the establishment of the iron trade in England and certainly in South Yorkshire and the Sheffield district. It is stated that the monks had fairly extensive ironworks: "two works for smelting the ore and two for forming the bars." A writer in "Local Notes and Queries"† refers to the use of the

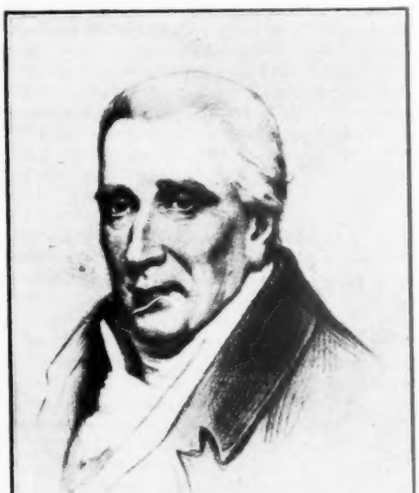

Fig. 3.—Joshua Walker, the Brother in Charge of the Foundry Section of the Walker Enterprise.

Ex "Historic Notices of Rotherham," Guest; by permission of the Chief Librarian, Sheffield.

word "forges" in the original charter, and states that the manner of its use seems to indicate that the forges were in existence at the time this charter was granted. The site of this monkish ironworks was variously known as Thundercliffe or Cindercliffe, a name which some historians have attempted to associate with Thorncliffe of to-day. This site is still to be seen, and, writing in the "Sheffield Hallamshire," Mr. T. W. Hall states that the site has not suffered serious change since the monks were dispossessed by Henry VIII. The Smithy houses, which were renovated in 1928, are still to be seen, a little to the left of Keppel's Column, the prominent memorial standing on Thorpe Common. Smithy Wood now gives its name to the vast coke-oven plant of the Thorncliffe Distillation Company, Limited.

It is interesting to speculate on the early application of coal in this district to metallurgical processes. There is an old lease, still extant (T. W. Hall, "Sheffield Hallamshire") which suggests that coal was worked at Cortworth in 1369. Leland writing in 1550, almost two centuries later, commented on the fact that, although "betwixt Cawoode and Rotherham be plante of woode, yet the people burne yerth-cole, by cause hit is plentifully found there and sold good chepe. A mile from Rotherham be veri good pittes of cole. In Rotherham be veri good smithies for all cutting tools." Leland in his journeys extending over the years 1536 to 1542 also found "Many smithies and cuttelars in Hallamshire."

Early Patents

John Copley, in association with William Astell and Francis Crofts, was granted a patent No. 38, March 20, 1627, including the "way and meanes for melting of iron oares, and for makeing the same into cast works and barrs with seacoles and pittcoles in furnaces and fyneries with bellowes." This patent is six years later than the classical patent of Edward, Lord Dudley, and it is highly probable that the John Copley is of the same family as the Captain Copley who owned the Chapeltown furnace in 1678* and the Lionell Copley, of whom it is recorded in 1662 and 1668 that he bought 850 tons of sow iron from George Sitwell, valued at £4,533 (approximately £5 6s. 8d. per ton), and who was ready to make 5,000 pounds worth of iron bullets for the navy. The preamble of the patent is of special interest and reads: "Whereas divers persons have heretofore undertaken by melting iron ore with seacole and pittcole to make . . . cast works and bars . . . in furnaces with bellows . . . and . . . have, about six years since . . . obtained several Letters Patent . . . but failing in their experiments and conclusions have in all this time effected nothing for the benefit and comfort of the Commonwealth . . . and for our gracious intention to his humble request the said William Astell and his associates have tendered unto us yearly rent of four hundred pounds. . . . Which creation of rent, as it surmounts all former conditions in grants of the same nature, so it intimates and ratifies a strong and solid assurance in the said William Astell and his coadjutors for real and essential performance of what they undertake. . . ."

Habershon speaks of this Chapeltown furnace as the place where probably was made the cannon which the Duchess of Newcastle says was ordered by her husband after he had taken possession of the Sheffield Castle on behalf of Charles I. He is able to state that in 1678 this furnace was definitely in the hands of Captain Copley, and for how long before then history is silent. These references are of a fragmentary nature, but, as they stand, probably constitute the earliest references to the actual casting of iron in the vicinity of Sheffield. At this date, Abraham Darby, of Coalbrookdale fame, was a baby two years old, having been born in 1676 at Sedgley, near Dudley. It is known that at Coalbrookdale ironworks existed prior to Darby's time, and in the seventeenth century, in the year 1696, there were two furnaces, together with forges, which were leased by the Brooke trustees to Shadrach Fox, from whom by sub-leases they came ultimately into the hands of Darby in 1708.

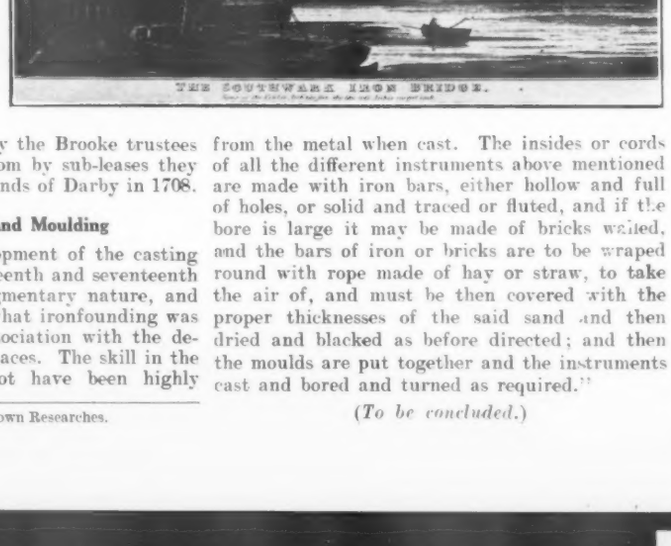

Fig. 4.—The Southwark Iron Bridge, built by the Walkers of Rotherham.

Ex "Historic Notices of Rotherham." Guest; by permission of the Chief Librarian, Sheffield.

Introduction of Sand Moulding

The history of the development of the casting of cast iron during the sixteenth and seventeenth centuries is of a very fragmentary nature, and it is highly probable that what ironfounding was carried on was done in association with the development of the blast furnaces. The skill in the art of ironfounding cannot have been highly developed, for Henry VIII found it necessary to employ as gun founders a number of foreigners, of whom the most famous were Peter Bande, Arcanus de Cesena and Van Cullen, and probably most of the founding in cast iron was devoted to the production of cannon and shot for the various wars which took place during this period. The patent records at the end of the seventeenth and the early part of the eighteenth century throw some light on the state of the art of casting. Abraham Darby's invention, dated April, 1707, was entitled the "New Invention of Casting Iron-bellied Pots and Other Iron-bellied Ware in Sand only without Loam or Clay." The exact nature of this discovery of Darby's is not now clearly understood, and if speculation is allowable, he might be credited with the introduction of dry-sand or possibly green-sand moulding methods in conjunction with multi-parted moulding boxes. The view is possible that moulding methods prior to this time were carried out principally with loam or clay as a medium, for we have later in 1758 a patent due to Isaac Wilkinson, the father of John Wilkinson, which refers to a method of casting guns or cannon, cylinders, pipes and sugar rolls using sand as a medium and describing in detail the sand mixture, the use of multi-parted boxes, drying, blacking and the construction of core-barrels, operations which are so familiar to the foundryman to-day that they can be scarcely credited to have ever been the subjects of invention.

"The outside or cope of the mould or moulds in which the guns or cannon, fire engines, cylinders, pipes and sugar rolls is or are intended to be cast must be made of sand, mixt with a little horse or cow dung, or any other thing to make it porous. This sand is made wett and then rammed up, the patern, being first put in iron boxes made for that purpose of two, three, four, five, or any number of parts or pieces. As the nature of the instrument to be cast requires; then the boxes are to be taken asunder into pieces and the patern taken out; then the sand in the boxes is dried in a stove and, when dry, it must be blacked or faced with some wett charcoal dust; or black lead or any other mixture or thing to make the same come off or apart from the metal when cast. The insides or cords of all the different instruments above mentioned are made with iron bars, either hollow and full of holes, or solid and traced or fluted, and if the bore is large it may be made of bricks walled, and the bars of iron or bricks are to be wraped round with rope made of hay or straw, to take the air of, and must be then covered with the proper thicknesses of the said sand and then dried and blacked as before directed; and then the moulds are put together and the instruments cast and bored and turned as required."

(To be concluded.)

* Charter is given in "Dugdale's Monasticum." Vol. V, p. 421.
† "Sheffield Independent," p. 63. Sheffield Reference Library.

* Habershon, Chapeltown Researches.

The Institute of Vitreous Enamellers

FIRST ANNUAL CONFERENCE, SECOND DAY

Works Visit

On Saturday, September 29, by kind invitation of the directorate, the members visited the extensive works of the Parkinson Stove Company, Limited, of Stechford, near Birmingham. The guests, who were received by Mr. R. J. Rogers, the managing director, were conducted round the works in small parties. The firm, which employs about 1,000 hands, entered their present premises in 1914, which occupy an 18-acre site. It was one of the first firms to realise the desirability of supplying gas-fired cookers finished by vitreous enamelling.

The enamelling department comes within the category of a model shop, as the spray booths, drying stoves and enamelling furnaces are extremely modern. The handling arrangements have been well thought out, whilst cleanliness throughout the shop is obvious. This firm melts its own frit in oil-fired rotary drum-type furnaces of 600-lb. capacity. The liquid is allowed to run into water tanks in order to effect "shattering," as the next process involves grinding to a fine powder. The foundry is a typical light-castings shop, wherein special attention is given to sand treatment. The stores and warehouses were obviously well organised, and the progressing of materials from department to department after close inspection at each is intelligently undertaken. During the morning, of a really wet autumn day, refreshment was offered to the visitors.

Business Meeting

The business meeting, held at the Grand Hotel, Birmingham, on Saturday afternoon, set a high precedent for interest and efficiency. Mr. W. H. Whittle presided at the opening of the proceedings.

Before the President delivered his address, the opportunity was taken of returning thanks to Mr. R. J. Rogers (managing director) and the other members of the board of the Parkinson Stove Company, Limited, whose works at Stechford had been visited earlier in the day.

The Chairman said he had been connected with the vitreous enamelling business for a considerable time, and he believed that this works visit was the first in the history of the industry in which an organised body, representing different trades, had had the privilege of inspecting a vitreous enamelling plant. He was very much impressed by the lay-out of the works, by the efficient organisation and particularly by the cleanliness, which was a credit to all connected with the management.

Vote of Thanks to the Parkinson Stove Company

Mr. W. S. Grainger, in proposing a vote of thanks to the firm, described the visit as unprecedented in the annals of the industry. It was the first time, he said, that a works had been thrown open to competitors, and they were deeply indebted to Mr. Rogers and his co-directors for making a start and breaking through such thick ice.

Mr. J. H. Coupe, in seconding the motion, said the works visit was of the greatest interest. He hoped there would be others, which he thought would be beneficial to the Institute and to the trade as a whole. The motion was cordially endorsed by the meeting.

The Hosts' Reply

Mr. R. J. Rogers, speaking in acknowledgment, expressed the sincere regret of the chairman of Messrs. Parkinson & Cowan, Colonel Woodall, that he had not been able to meet them personally. Colonel Woodall and the directors of the company had been only too glad to assist in any way in their power to make the first conference of the Institute a success. When, some months ago, Mr. Todd mentioned the formation of the Institute it did not take him (Mr. Rogers) very long to make up his mind that the Parkinson Stove Company, at any rate, should be one of the members. He was well aware that he would not be followed immediately, possibly, by his competitors in the gas-stove industry. He was convinced that the spirit shown in the formation of the Institute was the right spirit, and it was apparent that the right spirit had prevailed at the first conference. The days had gone by when reliance could be placed on secret processes and formulæ, or upon individuals. He welcomed the new spirit of co-operation, and the Institute could rely on the hearty assistance of his company.

Mr. Rogers spoke of the enthusiastic and able work of Mr. Todd, and said he hoped that as a result of the conference those firms which were sitting on the fence and wondering whether they were going to get anything out of membership of the Institute would soon make up their minds to join for the common good of the industry. It was important that the first meetings of the Institute should be successful and that the Institute should make itself felt in the industry. He did not doubt that as a result of the Birmingham meeting some of the firms still hesitant would be brought in.

The Chairman mentioned that it was proposed to form Northern, Midland and Southern Sections of the Institute, for which winter programmes had been arranged. These would be printed and circulated, and he appealed to members to attend the meetings and support the lecturers. He added that the Institute was fortunate in having as its President a gentleman of the standing of Dr. Mellor, who was one of the greatest authorities on a subject closely allied to vitreous enamelling, namely, ceramics.

The Presidential Address

Dr. J. W. Mellor, who was very warmly received, then took the chair and delivered his presidential address. He said:

First and foremost, allow me to thank you all for the great honour you have done me in electing me the first President of your Association. I was very pleased to learn that you were founding the Association, but I was very dubious about the wisdom of electing me, an outsider, to the office. However, it is no good crying over spilt milk, and we must make the best of it. I therefore beg of you to direct a blind eye to my shortcomings, and to view with a magnifying glass any merits I may have. This being the first general meeting, we have no past reminiscences to recount, but we have to thank the pioneers for their extraordinary energy and enthusiasm. The founding of such a society in these days calls for a tremendous amount of work. It is a worthy achievement to have brought this Institute into being. The hon. secretary, Miss Elliot, has certainly done a great deal to bring the inauguration of the Society to a successful issue. I am informed that whenever she has had negotiations with an awkward man, one interview has been sufficient to reduce him to the plasticity of modelling wax. I don't wonder. The wily committee evidently knew Marriott's well-known lines:—

> Man flattering man not always can prevail,
> But woman flattering man can never fail.

Time flies too quickly for me to indicate in how many different ways the services of this Association can be invaluable to the industry. Indeed, the very fact that you have felt the need for mutual co-operation and founded this Association shows that I should be attempting to evangelise the converted. We must remember that, although this Society has made so fair and promising a start, it is still in the nursery, and it will have to suffer ills analagous to those that characterise growth from childhood to manhood. The child requires nutritious food. Our Society requires nutritious Papers—Papers charged with an adequate proportion of vitamins.

An indefinitely large variety of Papers will, I hope, be forthcoming, and I would here and now make a special appeal to members to help the secretary and committees, by volunteering contributions. I am a believer in short, one-idea Papers. Plenty of members might be affrighted at the prospect of delivering an elaborate Paper, and yet each one could make very interesting communications as short notes, occupying but a few minutes; for example, notes on the most efficient speed for running a machine, the causes and remedies of particular faults, and a thousand-and-one other little tips.

We can easily make the mistake of being too ambitiously lofty in our aims. I have watched the effect of hundreds of Papers during the last 30 years in a society closely related to this one. Some Papers which the publication committee would unanimously condemn as "poor stuff" might prove more useful than some of the more brilliant Papers, because they provoke or stimulate discussion. A good discussion will bring out most useful information, and suggest ideas which others may subsequently develop in a beneficial manner.

In some societies and research associations there is a great demand for the so-called practical Papers; and some bewail the fact that academic Papers are too much in vogue. Academic Papers, I presume, are those which attempt to develop the fundamental principles, or the theory of the art. Of course, under modern conditions, theory cannot dispense with practice, nor can practice usefully dispense with theory. Each one supplements and completes the other. Practice without theory is mere empiricism or rule-of-thumb—equivalent to the precepts of the cookery book; theory without practice is day-dreaming—it travels along with its head in the skies until an unsuspected banana skin brings it to earth with a bump. There are people who are not in sympathy with the laudable desire to know "why the wheels go round," so to speak. They say that it is not practical. True enough, it is not necessary to know "how the wheels go round" in order to use a watch effectively and well; but it seems to me equally true that a man who manufactures or repairs watches should know the works inside-out. A man who has not mastered the fundamental principles of his work is not in a position to use new information, nor even to appreciate its value, though he may deride it in scornful terms.

In an essay, "Wanted, an Unpractical Man," G. K. Chesterton emphasised the idea in his own amusing and paradoxical manner. He said:—

> In our industries, a most singular fancy prevails—the fancy that when things go very wrong, we need a practical man. Would it not be more truthful to say that we need an unpractical man? A practical man is accustomed to daily practice, and the way things commonly work. If there is a slight indisposition in our practical work, a handy man will soon put things right, but if there is a serious illness it is more likely that some absent-minded old Professor, with wild white hair, will have to be dragged out of the college or laboratory to deal with the evil.

Of course, the outsider will talk a lot of rot, but he is as likely as not to drop some valuable clues which would be missed by a man blinded by familiarity with his own practice.

The practical man is guided by what he has been told, or by what he has seen before, and in all probability to him the old adage is true—an ounce of practice is worth a ton of theory. This adage is satisfactory so long as things are jogging along in the good old way, but the experience of a practical man is likely to fail him

completely when confronted with new phenomena and new conditions. There are also his prejudices to overcome, and time and again it has been found to be shorter and easier to proceed from ignorance to knowledge than it is from prejudice to knowledge. For example, in changing from direct coal-firing to gas-firing I have heard several experienced engineers say that it is better to begin with a man with no preliminary training in the art than it is to commence with a skilled routine fireman. The one does start with an unprejudiced mind, whereas the other's previous practice is an encumbrance which, I am told, usually prevents him from adapting himself to the new conditions. Yes! It is shorter and easier to proceed from ignorance to knowledge than it is from prejudice to knowledge.

It is extremely unlikely that our present programme of Papers will please all. There are sure to be criticisms which will remind us of a reflection of the ancient sage Aristotle, for, said he "some people are like puppies, they love to worry things," and one of the conspicuous tendencies of mere cleverness, as distinguished from ability, is the desire always to be picking things to pieces and destroying. *La critique est aisée et l'art est difficile;* I would rather say *La destruction est aisée mais la construction est difficile.*

Still, I doubt if it would be well for us to remain for any length of time undisturbed by currents of thought external to ourselves. It would be a serious calamity if we were to be shielded from criticism and to be protected from the healthy pain of hearing what others have to say of us and of our industry. There are industries which have been more or less isolated for over a century, they are located in certain restricted areas, and until comparatively recent times they have been protected from an interchange of thought with outsiders. There may not have been an inbreeding in a biological sense, but from a psychological point of view the results of an inbreeding of thought all these years is a particularly interesting phenomenon.

Like other societies in their childhood, it is just possible that the committee will have difficulties in procuring Papers for their meetings. After the first or second round, so to speak, there may be a famine. In many other industries there is cognate work progressing in colleges, technical schools and research associations which is a valuable auxiliary in providing nourishing food for their technical societies. I hope that as a result of meditations and discussions at our meetings we too shall attract some workers on the theory of enamelling because, as I have just indicated, our practice must be leavened with theory if the job is to attract the right sort of men, and the art must be lifted beyond the cookery-book stage where the precious recipe, kept in the safe, is the master of the works. There is an ideal to which we must aim, and that is to have a research association of our own, when the workers are guided by a managing committee in order to lead the work along utilitarian lines. I am not going to dwell on this subject. There is a lot of spade-work to be done before that stage is attained. But it is sure to come in its own good time.

The discussions at our meetings will, I hope, stimulate the imagination and zeal of many workers, and provide them with material for closer investigation. This I hope will incite them to fresh endeavours, and so will knowledge grow from more to more.

The applause which followed the address made a formal vote of thanks unnecessary.

The President next invited Mr. A. England, M.Sc., consulting and analytical chemist, to read his Paper entitled "Vitreous Enamelling on Cast Iron and Sheet Steel." The Paper, Dr. Mellor said, was most suitable as a starting point, inasmuch it gave a comprehensive survey of the whole industry. This was printed in our last issue.

DISCUSSION

To Mr. W. Thomason fell the distinction of opening the first discussion. He would like further information, he said, with regard to the method of obtaining the expansion of enamel. In the Paper figures were given which when multiplied by the appropriate expansion coefficient gave a total of 333.7. His point was that all the oxides enumerated had different gravities. The percentage composition was by weight, but the expansions were by volume. In his view, each of the items ought to have been corrected by its appropriate specific gravity, in which case they would have arrived at a totally different result from the figures printed and one in no way resembling the total expansion of cast iron or sheet metal. Also, it must be remembered that the example enamel quoted had the simplest possible arrangement of the base group—namely, Na_2O and K_2O, whose gravities were not very dissimilar. But most enamels contained also calcium in the form of fluoride or oxide, and frequently zinc oxide, barium oxide and even lead oxide, and it was his view that correction for gravity was essential in any calculation of expansion from chemical composition by weight. He further suggested that the same criticism applied to the method adopted for the calculation of the modulus of elasticity. The figures quoted appeared to be for the most part German in origin. He thought many of the German figures published, and accepted as authoritative in this country, were very frequently the work of young German chemists writing theses for their degrees. Not infrequently the figures had not been scrutinised with the attention that they should receive before being accepted as a really serious contribution to the literature of the subject. The general survey given by Mr. England seemed to him to be excellent, but he would like to ask if the point of view he (Mr. Thomason) had indicated had been considered.

Composition of Cast Iron in Vitreous Enamelling

Mr. V. C. Faulkner said he intervened in the discussion because the lecturer had referred to the composition of cast iron, and especially to silicon. He wished to point out that no growth took place in cast iron, no matter what the silicon content was, provided the section was sufficiently thin, and the sections they handled in the enamelling trade were of that category. He would like, however, to put before them for consideration the question of phosphorus in cast iron, because all enamelling irons had high phosphorus and it so happened that the phosphorus eutectic melted somewhere round 900 deg. C., a temperature possibly reached within the enamelling range. If the phosphorus eutectic was slightly liquid on the surface it might be either helpful or detrimental. Mr. Faulkner added that Mr. England had given a wonderful history of the industry and its development.

Soundness and a Clean Skin Essential

Dr. A. H. Angus agreed that the figures must be accepted with caution. It was well known, he said, that in the case of metals they could not estimate the final expansion from the constituents. For all that, in the initial stages of any investigation, a first approximation, even if 25 per cent. in error, was better than no knowledge at all. With regard to the analysis of cast iron, they had reached the conclusion that a normal cast iron could be enamelled, provided that it was sound. They were now considering a reduction of the silicon and were not quite sure what the effect would be. They were also considering a suggestion that the phosphorus should be lowered with the idea of reducing warping in the enamelling. But, from his experience, he was satisfied that any normal cast iron, provided that it was uniform, could be enamelled. Emphasis, however, should be laid on the fact that it must be uniform. Some control over the iron was essential from that point of view. The most important considerations were soundness in the iron and a clean skin for enamelling. A clean skin did not entirely depend upon sand-blasting, though the foundryman could help in that respect. It was frequently more difficult to obtain a perfectly sound casting for enamelling purposes if they were out at the same time to get the finest skin possible. A fine skin often meant minor porosities on the under surface. When blasted the porosity remained and that meant trouble in the final enamelling. Another factor in obtaining clean castings before enamelling was the quality of the moulding sand. If a moulding sand contained certain constituents it tended to burn on the surface of the iron and was very difficult to remove. The degree of treatment which sand received before being put into the mould was another important factor.

Physical Properties of Heterogeneous Mixtures

Mr. G. H. Abbott, referring to the physical data given in the Paper, expressed the opinion that before they could question the physics of the process they must know the chemistry better. Those who had seen a piece of enamel beneath the microscope knew that there was something in its nature like a piece of coke, consisting of heterogeneous material with a lot of occluded gas bubbles. Was it possible, he asked, to talk of any physical constant at all when they were dealing with a heterogeneous material? The lecturer had mentioned that in certain of the compounds formed in the frit metantimoniate was present, probably in suspension. In that case, too, could they talk about the physical constant of a chemical suspension?

Mr. J. Fallon asked Mr. England's opinion as to the carbon content of mild steel and its effect on the warping of steel under fusion treatment of the enamel. He would also like to know, he said, what Mr. England's view was regarding the effect of annealing or heat-treatment of a casting in relation to the gasification of the casting, and also the removal of the volatile constituents or any slight traces of moulding-sand facings.

Arrested Reactions

The President said it must be remembered that, in the case of enamel, there was not a completed reaction. Twenty or thirty years ago he drew attention to the fact that many of our industries depended on what he called arrested reactions—reactions which proceeded a certain distance and then stopped. Perhaps the best illustration was the cooking of a cake; let the reaction go to the end, and the result was charcoal. If enamels were examined, it would be found that the particles had never really all dissolved. There was a mixture of all sorts of materials, and the flux came into them and started gobbling them up. But the job was never finished. How could the measurement of the coefficient of expansion be applicable to a case like that? There was a mechanical process going on, and in the enamelling industry they arrested it at a certain stage.

AUTHOR'S REPLY

Mr. England, dealing with some of the points raised in the discussion, referred to Mr. Thomason's remarks on the question of weight and volume, and said that the figures given were figures which had proved themselves in actual use, both in glass and enamel. He was not going to enter into the question of unfinished reactions. "I should probably get it where the chicken got the axe," he remarked, amid laughter. In reply to Mr. Faulkner, he agreed that silicon had a big influence on cast-iron enamelling, while the phosphorus eutectic was certainly worthy of consideration as a research point. After hearing the observations of Dr. Angus, he thought they would agree that he ought to be persuaded to give a lecture on cast iron for enamelling purposes. As to the remarks of Mr. Abbott on physical and chemical constituents, the whole difficulty of the structure of

enamels was the numberless variants to be considered, and when they were considering chemical variants, they had also to consider physical.

Vote of Thanks

Mr. W. S. Grainger proposed a hearty vote of thanks to Mr. England for his "ambitious, comprehensive and admirably-delivered" Paper. Mr. England had undoubtedly given an enormous amount of time, thought and research to the compiling of such a record of facts, figures and formulæ. The Institute was extremely fortunate in having had such a first Paper submitted, which established it as a society definitely useful to the industry in which they were all interested. Mr. England's Paper was so wide in its scope that they could treat it as a catalogue from which they could extract enough material to form the basis of research and technical Papers for many years to come. If the results were valuable to the industry as a whole, the formation of the Institute would have been worth while.

Mr. W. H. Whittle, in seconding the motion, agreed that the Institute was fortunate in having such a Paper read at its first meeting, and hoped that it would be the inspiration of a number of subsequent lectures.

The President associated himself with the tribute of thanks to Mr. England for his valuable Paper, remarking that he could not imagine a better Paper for the start of the Institute's work.

The vote of thanks was carried by acclamation, and Mr. England briefly acknowledged the compliment.

A Scottish Section

Mr. J. G. Roberts (Messrs. Shanks & Company, Barrhead) inquired what support for the Institute had been forthcoming in Scotland. He suggested that a Scottish Section might be formed, in addition to the North of England Section.

Mr. Whittle replied that the whole of the firms in the country connected with vitreous enamelling had been circularised. There had been a considerable amount of publicity, and members of the Council had done a great deal of evangelistic work with the aim of bringing firms in. Up to the moment they had two firms from Scotland as members and two individual members connected with other firms. There was a vacancy on the Council which had been specially kept open for a Scottish representative, and if the response from Scotland was sufficient it would be necessary to form a Scottish Section, or ultimately a Scottish Branch. If their Scottish friends could do anything to cause an influx of members over the Border, they would be very glad.

Mr. William Todd said they had the pleasure of conducting a party of their confrères from the Falkirk district round the works of the Parkinson Stove Company earlier in the week, when he took the opportunity of mentioning the possibility of forming a Scottish Section with headquarters at Falkirk. The visitors threw out the suggestion, which he intended to pass on to the Council that the Council might arrange for a delegation to visit Falkirk and hold a meeting in order to stimulate interest.

In closing the proceedings, the President said he had been very happy to take part in the first Conference. He had been greatly impressed by the earnestness that had characterised the meeting, and also by the far-reaching influence which the work, started that day, was likely to have on the industry. "I see a great future before us," he added.

Newspaper Correspondence

The following correspondence has been received and published by "The Birmingham Post":—

From Mr. Rupert Baugh

Sir,—In your report of the first conference of The Institute of Vitreous Enamellers, held at the Grand Hotel, Birmingham, on Saturday last, Mr. England, in the Paper which he read on "Vitreous Enamelling on Cast Iron and Sheet Steel" is reported to have said:—

> Messrs. T. F. Griffiths & Company, of Birmingham, worked a process, patented by Charles Henry Paris, for the production of hand-made and stamped hollow-ware, and soon after this for the production of enamelled advertisement plates, the latter branch being carried on in a separate factory which afterwards became the Patent Enamel Company. This factory was still in existence as a branch of Associated Enamellers, Limited.

May I use the "Post" to make a correction? Messrs. T. F. Griffiths & Company were not vitreous enamellers. They certainly made the blanks and sold the finished article, but the vitreous enamelling was done for them by the late Benjamin Baugh, who later took out patents relating to enamelled advertisement plates, decorative panels, etc., and traded under the name of the Patent Enamel Company in Bradford Street, Birmingham.

The factory is not now in existence, as the business was transferred some forty-five years ago to premises which had been built for that purpose at Selly Oak, Birmingham.

Rupert Baugh,
Managing Director,
Patent Enamel Company.

Selly Oak.

From Mr. Harry Margetts

Sir,—I was more than interested to read of the formation of an "Institute" for this industry and must congratulate Mr. A. England on his Paper. Many names he gives as pioneers of the trade, but I should like to ask him what part the late Benjamin Baugh played in this industry? Surely he cannot be overlooked.

Harry Margetts.

Chesterton Road,
Sparkbrook.

From Mr. Frank Noake

Sir,—I was not able to attend the reading of Mr. England's Paper, but I think the pioneer work of Powell at Clark's Works, Wolverhampton, should be recorded, especially on the scientific side. The great and early influence of Italian and Spanish (Moorish) enamellers should also be recorded. The latter are especially strong in beautiful blue products, often obtained with crude materials and appliances but great skill.

Frank Noake.

149, Yardley Fields Road,
Yardley.

LIST OF MEMBERS

Southern Section.

J. H. Coupe, 63, Ridge Avenue, Winchmore Hill, N.21.

James Gray & Sons, Limited, 5, Victoria Street, S.W.1. (Rep.: Mr. J. T. Gray.)

J. H. Gray, 5, Victoria Street, S.W.1.

A. G. Gray, 5, Victoria Street, S.W.1.

Clifford Christopherson & Company, Limited, Marlow House, Lloyds Avenue, E.C.3. (Rep.: Mr. W. J. Hatchley.)

Sterling Manufacturing Company, Davis Street, Cubitt Town, London, E.14. (Rep.: Mr. B. B. Kent.)

Bernard B. Kent, Sterling Manufacturing Company, Davis Street, Cubitt Town, E.14.

A. B. Kent, 33, Bromley Avenue, Bromley, Kent.

V. C. Faulkner, The Foundry Trade Journal, 49, Wellington Street, Strand, W.C.2.

James Bruton & Sons, Hedge Lane, Palmers Green, N.13.

Borax Consolidated, Limited, Regis House, King William Street, E.C.4.

National Enamels, Limited, 53, Norman Road, Greenwich, S.E.10. (Rep.: Mr. H. G. Fry.)

Industrial Newspapers, Limited, 49, Wellington Street, Strand, W.C.2.

Elm Works, Limited, Summerstown, Tooting, S.W.17. (Rep.: Mr. H. Savage.)

The Union Oxide & Chemical Company, Limited, 1-2, Pepys Street, Seething Lane, London, E.C.3. (Rep.: Mr. W. Astles.)

Aerograph Company, Limited, Lower Sydenham, S.E.26. (Rep.: Capt. J. D. Whiteman.)

J. F. Stewart & Company, Limited, Paisley Works, Swain's Road, Tooting, S.W.17. (Rep.: Mr. W. Thomason.)

Gordon Henry Abbott, 32, Foyle Road, Blackheath, S.E.3.

William Thomas, Atlantic House, Holborn Viaduct, E.C.1.

William Edward McCalla, 48a, Oakmead Road, London, S.W.12.

Johnson Matthey & Company, Limited, 73-82, Hatton Garden, E.C.1. (Rep.: W. G. Franks.)

G. Redman, 23, Galliards Avenue, Edmonton, N.9.

Brandhurst Company, Limited, Vintry House, Queen Street Place, E.C.4. (Rep.: H. R. Cuzner.)

H. W. Newark, 6, Sedcote Road, Ponders End, Enfield, Middlesex.

The Gramophone Company, Limited, Blyth Road, Hayes, Middlesex. (Rep.: Mr. Muzzell.)

D. M. M. Brunton, 10, Sunnyside Drive, Chingford, E.4.

R. Curry, 45, Chesterfield Road, Enfield Wash, Middlesex.

G. C. Clayton, 16, Grosvenor Place, S.W.1.

T. J. McArthur, 44, East Ferry Road, London, E.14.

Franco-British Elec. Company, Limited, 25, Oxford Street, London, W.1. (Rep.: A. H. Brackensey.)

Midland Section.

W. Noake, Bittell Road, Barnt Green, Worcestershire.

Wengers, Limited, Etruria, Stoke-on-Trent.

Beech & Chambers, Enamels, Limited, 147-9, Bridge Street West, Birmingham, 19. (Rep.: Mr. F. Guy Beech.)

T. Chambers, 147-9, Bridge Street West, Birmingham, 19.

Stocal Enamels, Limited, Dallow Street, Burton-on-Trent.

W. S. Grainger, Stocal Enamels, Limited, Burton-on-Trent.

The Chromographic Enamel Company, Dudley Road, Wolverhampton.

C. J. Baines & Company, Limited, Sutherland Colour Works, Stoke-on-Trent. (Rep.: Mr. C. J. Baines.)

The Incandescent Heat Company, Limited, Cornwall Road, Smethwick, Birmingham. (Rep.: Mr. John Fallon.)

Blythe Colour Works, Limited, Cresswell, Stoke-on-Trent.

Vitreous Enamelling Company, Limited, Rushey Lane, Tyseley, Birmingham. (Rep.: Mr. H. C. Carver.)

W. Todd, Parkinson Stove Company, Stechford, Birmingham.

Hurst Hill Enamel Company, Limited, Biddings Lane, Deepfields, near Bilston. (Rep.: Mr. J. Nicholls.)

C. E. Ramsden & Company, Limited, Foley Colour & Chemical Works, Fenton, Stoke-on-Trent. (Rep.: Mr. J. H. Davidson.)

J. W. Gardom, Wellington House, Bennetts Hill, Birmingham, 2.

T. Holcroft & Sons, Limited, Ettingshall Foundry, Wolverhampton.

Asbury, Brodie & Company, Limited, 55, George Street, Birmingham. (Rep.: Major J. K. Brodie.)

Aga Heat, Limited, Mafeking Road, Smethwick, Staffs. (Rep.: Mr. H. Ingleby.)

XUM

A. J. Spittle, 52, Fitzroy Avenue, Harborne, Birmingham.
P. W. Davis, Enamelled Iron & Steel Products, Company, Oldbury, Birmingham.
H. Green, Enamelled Iron & Steel Products Company, Oldbury, Birmingham.
Keeling & Walker, Limited, Stoke-on-Trent. (Rep.: Major J. K. Brodie.)
Thompson L'Hospied & Company, Limited, Stourbridge.
Ferro Enameling Company (England), Limited, Ounsdale Road, Wombourne, Wolverhampton. (Rep.: Mr. Wm. Marshall.)
Parkinson Stove Company, Limited, Stechford, Birmingham. (Rep.: Mr. R. J. Rogers.)
Stanley Hallsworth, 1, Douglas Avenue, Ward End, Birmingham.
T. Fearnley Allen & Son, Norwich Union Chambers, Congreve Street, Birmingham, 3. (Rep.: Mr. Andrew E. Allen.)
A. G. Read, 26, Edgcombe Road, Hall Green, Birmingham, 11.
S. R. Read, 26, Edgcombe Road, Hall Green, Birmingham, 11.
J. F. Staney, Parkinson Stove Company, Stechford, Birmingham.
B. E. Hobley, Emscote Foundry Company, Limited, Warwick.
The Valor Company, Limited, Wood Lane, Bromford, Erdington, Birmingham.
The British Thomson-Houston Company, Rugby.
Sydney Wright, 16, Willow Avenue, Edgbaston, Birmingham.
Alan Blair Allan, "Clydesdale," 94, St. Paul's Road, Smethwick.
H. H. Aston, John Harper & Company, Limited, Albion Works, Willenhall.
Kenneth Hill, "Glen Garrie," Alexandra Road, Penn, Wolverhampton.
Dr. H. T. Angus, 331, Station Road, Yardley, Birmingham.
W. & T. Avery, Limited, Soho Foundry, Birmingham.

NORTHERN SECTION.

W. H. Whittle, Protector Lamp & Lighting Company, Limited, Eccles, Manchester.
H. Bradley, Crumblehulme, Limited, Derby Iron Works, Rothwell Street, Bolton.
Crumblehulme, Limited, Derby Iron Works, Rothwell Street, Bolton. (Rep.: Mr. Jukes.)
The Protector Lamp & Lighting Company, Limited, Eccles, Manchester. (Rep.: Mr. W. H. Whittle.)
J. L. Prestwich, The Protector Lamp & Lighting Company, Limited, Eccles, Manchester.
F. Prestwich, The Protector Lamp & Lighting Company, Limited, Eccles, Manchester.
J. H. Prestwich, "Beech Hurst," Fairhope Avenue, Salford, 6.
H. Whitaker, Rustless Iron Company, Limited, Trico Works, Keighley.
Rustless Iron Company, Limited, Trico Works, Keighley.
The National Radiator Company, Limited, Hull, Yorkshire.
The Carborundum Company, Limited, Trafford Park Road, Trafford Park, Manchester. (Rep.: Mr. W. B. Cleverly.)
Harrison Bros. (England), Limited, Atlas Foundry, Commercial Street, Middlesbrough. (Rep.: Mr. A. Edwards.)
Stoves, Limited, Rainhill, Liverpool.
Harold Jukes, The Cottage, Lever Grange, Bradford Road, Bolton.
Joseph Barnes, 3, George Barton Street, Bolton.

SCOTTISH MEMBERS.

Shanks & Company, Limited, Tubal Works, Barrhead, Renfrewshire. (Rep.: Mr. J. G. Roberts.)
J. G. Keith, Wellside Terrace, Falkirk, Scotland.
A. Biddulph, Academy House, Falkirk.
Smith & Wellstood, Limited, Bonnybridge, Scotland.

Embrittlement of Low-Carbon Steel

A Paper on "The Embrittlement of Low-Carbon Steel" has been presented by PROF. F. C. LEA and MR. R. N. ARNOLD to the Institution of Mechanical Engineers, for written discussion. Contributions should be sent in before October 31. We append the authors' conclusions.

Conclusions

(1) Internal change is promoted in a low-carbon steel if it is left unstressed at atmospheric temperature after water quenching from 650 deg. C. The change occurs rapidly at first, but equilibrium appears to be attained after an ageing period of 30 days. Increased hardness, tensile strength, and fatigue limit, with decreased ductility, and resistance to impact, are the results of such ageing. A steel having 0.12 per cent. carbon exhibited an increase in hardness and tensile strength of 55 per cent. and 43 per cent. respectively, with a decrease of 75 per cent. in impact value.

(2) The magnitude of the change due to the preceding treatment is dependent on the carbon content of the steel, the lower carbon content showing the more pronounced effect.

(3) The water quenching of low-carbon steel in the region of 750 deg. C. produces instantaneous brittleness. Quenching at higher temperatures in the critical range has a less drastic effect, exceptional toughness being produced in a 0.12 per cent. carbon steel. This recovery of impact resistance at the higher temperatures is, as perhaps might have been expected, not evident in a 0.46 per cent. carbon steel.

(4) Low-carbon steels are liable to embrittlement by ageing at atmospheric temperature after quenching from temperatures between 550 and 850 deg. C. Maximum brittleness occurs in the range of from 675 to 775 deg. C., and is very pronounced in a steel of 0.12 per cent. carbon. Little embrittlement due to ageing is evident in steels containing 0.29 per cent. carbon and over.

(5) Quenching a 0.12 per cent. carbon steel from 800 deg. C. and ageing at atmospheric temperature for 50 days gives to the steel superior mechanical properties. By this means a tensile strength of 40 tons per sq. in. may be obtained, with an impact value of 40 ft.-lbs. The increase in strength is due partly to quenching, and partly to ageing.

(6) Age embrittlement of a 0.12 per cent. carbon steel after quenching from 700 deg. C. may be entirely counteracted by ageing at 100 deg. C. for 4 hrs. The accelerated ageing produces increased hardness which is not associated with brittleness.

(7) Age embrittlement may be brought about rapidly by cold-working a mild steel after quenching from 700 deg. C.

(8) It is suggested that the age embrittlement of low-carbon steel at atmospheric temperature is due to some internal movement within the crystal lattice, which X-ray analysis has failed at present to identify. Precipitation would appear to occur at higher ageing temperatures, unaccompanied by brittleness.

(9) Embrittlement phenomena may occur in normal case-hardening treatments. The results suggest the adoption of a hardening temperature of 800 deg. C. This should be followed, without exception, by tempering for a few hours between 100 and 200 deg. C., in order to obviate brittleness in the core.

New Zealand Iron and Steel Industry

To reduce unemployment, it is proposed to establish an iron and steel industry in New Zealand, and investigations are now being made in Nelson province, where extensive iron-ore deposits have been located. Previous attempts have been made with Government assistance to develop these deposits, but without success.

Sir William Larke and the Steel Industry

EFFICIENCY AND CO-OPERATION

Sir William Larke, Director of the British Iron and Steel Federation, addressed the Sheffield Metallurgical Association in the Mappin Hall, Sheffield, last week, on the subject of "Industrial Efficiency." Mr. S. A. Main, President of the Association, presided.

It was possible for industry to be technologically efficient and financially bankrupt, said Sir William. But he did not think the British iron and steel industry need yield to any industry in any country on technological efficiency. Critics often asked why the industry did not copy American mass production methods to a greater extent. He would remind those critics that mass production processes required mass markets, and this country did not—in regard to most of its products—possess such mass markets or the means of attaining them. On the other hand, America had an enormous closed market. It must be remembered also that we produced a larger number of different products in the British iron and steel industry than any other industry in the world, but our total production was one-fifth of that of the iron and steel industry of the United States. The methods of America were totally unsuited to this country.

Difficulties Mainly Economic

Industrial difficulties in this country were mainly economic and not technological, for British industrialists, and the British worker, were not only equal, but generally superior to any others in the world. In post-war years erstwhile consuming markets had become producers of the very products we formerly exported to them. Not content with doing that, they had also, in fact, commenced to export—and export into our own market.

He would like to replace competition by co-operation. It was not impossible to rebuild international trade if we could build a new efficiency of a collective character. One successful example of this co-operation concerned fuel, which had resulted in a saving of £1,750,000 per annum, after five or six years' work.

Referring to grouping of concerns, Sir William said some people thought these were already larger than could be really effectively controlled. He did not hold that view, but he was in favour of a unit capable of control by a single mind, particularly as regards policy and decisions which must be taken quickly to adapt themselves to circumstances. In most countries there was one large commercial organisation for the purpose of controlling national policy. In Britain they had commercial associations endeavouring to regulate the distribution of particular products on a basis to eliminate uneconomic and uncontrolled competition—in consultation with the consumers, which was important. They were making a very real effort to overcome present economic difficulties by a policy of co-operation instead of a policy of indiscriminate competition. By that means they should be able to regulate production to demand, and determine in what direction industry should be extended. He looked forward to the time when every one of the many industries they called iron and steel—there were 14 or 15 in the Federation—would either have individual effective export trade organisations or would participate in a more comprehensive export association.

Only at Beginning of Steel Age

They had not yet created anything like the demand for steel that they could create. Scientists and technologists must help to develop markets. He was confident that we were only at the beginning of the steel age.

The Master Cutler (Mr. Alexander Williamson), who joined in the discussion, said that in Sheffield there were research laboratories as good as any in any part of the world, and it was to the men in charge of these laboratories that the industrialists had to look. Imagination was the root of progress and he would ask them to set their imagination to work more furiously than ever before. Then they would find new products, new channels of trade, and increasing employment.

Mr. A. J. Grant agreed that the keynote of a policy for better prosperity in the iron and steel industry was co-operation.

Dr. W. H. Hatfield spoke of the value of collective research and of the importance of "technological salesmanship."

The Pipe Foundries of the Staveley Coal & Iron Company, Limited

VERTICALLY-CAST PIPE FOUNDRIES

The history of the pipe foundries of the Staveley Coal & Iron Company, Limited, represents upwards of 230 years of uninterrupted and progressive activity. The record of the actual date of the earliest developments at Staveley is, unfortunately, not available; but an authentic document in possession of the firm shows that the foundries were in operation so far back as 1702. The first blast furnace was probably the one built under the brow of Barrow Hill, the site of which is to-day called Furnace Hill. This furnace output would not exceed a few tons per per week and the iron made would no doubt be used mainly on domestic account.

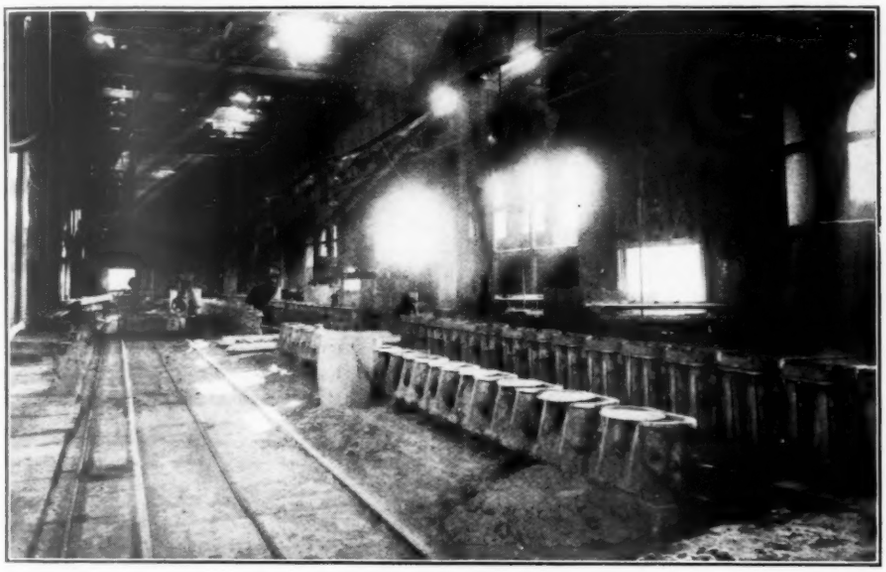

Fig. 1.—View in No. 12 Pipe Foundry for Vertically-Cast Pipes.

It may, however, be said that the manufacture of pipes has been a staple activity of Staveley for at least a century. A portion of the present foundries devoted to the production of vertically-cast pipes occupies the site of the original foundry, and from that small initial venture has been built up a works covering an area of 102 acres and with an output capacity of 100,000 tons of vertically-cast pipes per annum, an output which as a matter of fact has been fairly constant for some years.

Prior to 1906 the works were entirely self-contained, the iron being produced in eight blast furnaces, all of the open-top type, from local ores. Some of the blast furnaces had been in service for upward of 40 years, and although they had been kept tuned up to the limits imposed by the design, their output capacity was not equal to the growing demands of the pipe foundries. It had also to be recognised that they were fast reaching the end of their useful lives, and to rebuild them on their then existing lines would not have been an economic proposition.

The late Mr. Charles P. Markham, engineer and chairman of the Staveley Company, with his usual far-sighted policy, determined to make the necessary extensions by the erection and equipment of a new works on an adjacent site rather than attempt to re-design the existing plant. In furtherance of his scheme the erection of the now well-known Devonshire Works was commenced, the first objective of the works being to increase the production of iron to meet the demands of the foundries. The works were extended to take over the whole duty of pig-iron manufacture, which in point of fact was done many years ago, though it was not until 1928 that the last of the old blast furnaces was dismantled.

As the Devonshire Works were really an extension of the Staveley Works, these last may still be regarded as self-contained, smelting their own pig-iron, casting and finishing the pipes, which are moulded with materials mined from their own quarries, whilst even the wood wool used in the manufacture of cores is prepared in the works. Wherever practicable, steel tubes are used in place of cast iron for core bars. The pipes cast cover the complete range from 1½ in. to 72 in. dia. of standard lengths and in metric diameters and lengths to specifications for export. Foundries are laid off for casting special shapes and also for the manufacture of flanged pipes. The demand for these last, which are usually supplied in the machined and drilled condition, has recently shown a very substantial increase, the present output being about 200 tons per month.

In pipes, as in every other form of production, demands have become more exacting, and at the Staveley foundries no pains have been spared to meet those demands; indeed, one might almost say to go a little beyond them. Obviously to produce good pipes one must have good equipment, and at the Staveley Works there has been gradually evolved a very complete system of limit gauges, thus rendering the production of a pipe, so far as practical, a mechanical proposition. Steel tubes are used in place of cast iron for the core bars. The first cost is of course higher, but the useful life infinitely longer, and, what is of paramount importance, the results are better.

All equipment, patterns, core boxes, etc., are machined to predetermined limits and are finally gauged by the inspection staff before being passed into the works.

In the vertically-cast pipe foundries all moulds are hand-rammed. Various systems of mechanical ramming have been thoroughly tried out, and it has been determined that the hand-rammed mould is the most consistently free from hard and soft places, which of course produce blemishes on the skin of the pipes. It will not be necessary in this article to deal separately with the several foundries; it will be sufficient if we consider the equipment as a whole and the general method of procedure.

The foundries are served by 15 Craven cranes ranging from 6 to 30 tons. These cranes are of somewhat unusual design, combining an electric travel with a hydraulic hoisting motion. This arrangement has been developed by the Staveley Company, and furnishes that steady even movement which is essential when stripping patterns. The hydraulic power is taken from "walking" pipes at 700 lbs. per sq. in. pressure.

Melting and Casting Plant

The melting plant comprises 18 cupolas ranging from 3 to 19 tons per hour capacity. A considerable number of these cupolas have been converted to the balanced-draft system which has been developed by the British Cast Iron Research Association, of which the company are members.

Fig. 2.—View in One of the Pattern Shops.

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The whole of the working of the cupolas, including the composition of the charges, etc., is directly under the control of the chief chemist of the foundry department and his staff. The chemical composition and physical properties of all materials used, both metallic and refractory, are also controlled from the laboratory—in addition to the final tests of the castings sent out. In all there are some 27 casting pits of both rectangular and circular types. Pipes up to

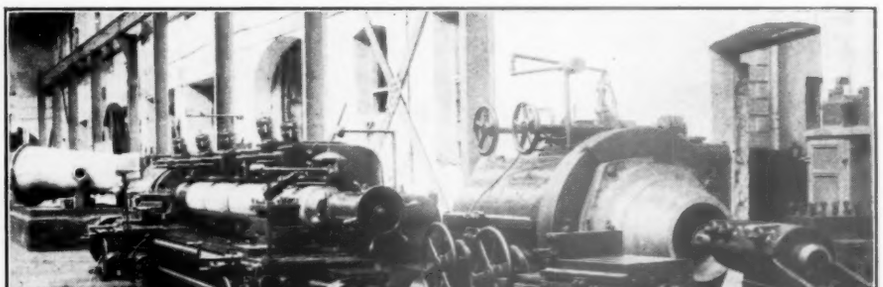


Fig. 3.—View showing a Section of the Fitting and Machine Shops.

18 in. dia. are cast in fixed boxes, movable boxes being used for the larger sizes.

The boxes are split with a vertical joint; the face of the box remote from the fixed portion is either hinged or slides on guides. The two sides are secured in proper relation to each other by cotters and dowels. The socket pattern is secured to a hinged swinging plate at the bottom of the box; this is swung into position and held in true alignment with the box by cotters and dowels. The body pattern, consisting of a cast-iron cylinder having a tapered nose piece on its bottom end, is then lowered through the box till the tapered nose piece connects with a similar recess in the socket pattern, thereby ensuring concentricity between socket and body. Sand is then fed into the mould by gravity and hand-ramming proceeds till the mould is complete. The body pattern is withdrawn from the mould and the socket pattern similarly removed. The mould is then blacked by means of a distributing hopper which is placed above it, any surplus blacking falling into a tray placed beneath. A gas flue runs beneath all the casting pits, and from this connection is made to burners for drying the moulds, producer gas being employed.

The cores, made by striking up loam on a steel or iron core barrel, are dried, blacked and dried again in gas-fired ovens, the socket cores being made and treated in a like manner. The cores are assembled in the mould, concentricity being secured at the bottom or socket end by means of a tapered connection similar to that used with the pattern, concentricity at the top or spigot end being obtained by individual adjustment. Very ample heads are provided on all moulds to cover shrinkage, as also to ensure all non-metallic material rising above the pipe proper.

After the casting has lost all colour the core is withdrawn, the pipe stripped and placed on a rail gantry, along which it is rolled into the fettling shop, and after fettling, still on the gantry, passed to the machine shop for finishing. Generally this machining is confined to removal of the head to length. Where, however, the pipes are designed for Victaulic or turned and bored joints, they are loaded on to transfer bogies and delivered to adjacent machines. This question of machining has received very careful consideration and many of the machines have been specially designed by the Staveley Company and give a remarkable degree of accuracy to the finished product, the working limits being 1½ thousandths. To meet the increased demand for finished flanged pipes, a new machine shop has been erected adjacent to the foundry devoted to the casting of such pipes, and the equipment of the shop contains a battery of Noble & Lund (Newcastle) special machines of a particularly robust character.

There are several foundries laid off for the casting of special shapes, each dealing with its own particular range of sizes. In these foundries various systems of moulding are adopted, sand slingers, pneumatic-jolting, hydraulic-pressing machines, etc., being used, as also hand and pneumatic rammers.

After the necessary machining, the pipes are delivered to the inspection areas, where they are visually inspected and gauged and finally each pipe is hydraulically tested to the requirements of the British Standard or other specification. It may be noted that all pipes are subject to this works inspection, regardless of the fact that they may be subject to inspection by the customer's inspector. Further, the inspection department is entirely independent of the production departments and is responsible to the general manager alone. After inspection the pipes are transferred to one of the three coating plants, where they may be dipped completely or coated externally, as is usual with gas pipes.

Where specifications call for concrete-lined pipes, the pipes, after inspection and testing, are transferred to the concrete-lining department, in which are installed two spinning machines. Concrete for the purpose is made in small batches. Nothing but washed sand is used as aggregate, and the greatest care is exercised not only as regards the composition of the mixture but also in regard to the time interval between mixing and spinning. The lined pipes are transferred to the maturing gantries, where they remain for a minimum period of three weeks.

The machine shop is exceptionally well equipped with a full range of modern tools capable of dealing with every class of casting. The shop is laid out particularly to deal with the tackle for the foundries, and the machines incidental thereto enable the shop to manufacture the majority of the plant used in the works; indeed, cranes and even locomotives have been built in the works. The boiler shop, which is mainly employed on maintenance work for the collieries, ironworks and foundries, contains a range of plate-bending rolls, flanging press, power hammers, oxy-acetylene and electric cutting and welding plants, etc.

With the exception of the springs, wheels and buffer rods, the wagon shop is capable of turning out 16 standard wagons per week, and in addition is responsible for the maintenance of 7,000 wagons which are owned by the Staveley Company. The shop provides standage for 48 wagons, and the equipment includes a smithy, drop-stamping plant, and all necessary machinery for dealing with the various wagon components. In a section of the shop all the parts for the pit tubs used in the company's collieries are made and finished; they are then sent to the various collieries to be there assembled. Within the ægis of the foundry department is a very fully-equipped saw mill, which deals with both British and foreign timber. The plant includes a log-cutting band saw, breaking-down saw, ripping saw, cross-cut, planing, mortising and drilling machines, etc. The saw mill provides the whole of the timber required by the wagon department, as well as the collieries and other departments of the company.

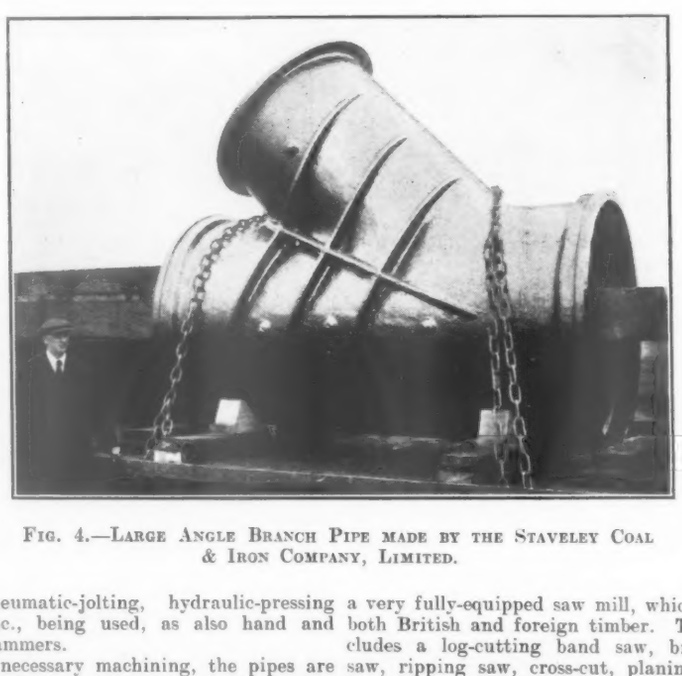


Fig. 4.—Large Angle Branch Pipe made by the Staveley Coal & Iron Company, Limited.

(*Concluded on page* 230.)

Foundry Conditions on Tyneside

MR. ROBSON'S PRESIDENTIAL ADDRESS

The opening meeting of the session was held at the Neville Hall, Newcastle-upon-Tyne, on September 29, when Mr. F. Robson, the newly-elected President of the Institute of British Foundrymen, delivered his address.

The meeting was preceded by a visit to the Dunston Power Station, and Mr. Robson stated that this was a forerunner of the very excellent programme which had been arranged for the session, details of which were given. The President dwelt upon the benefits to be derived from membership of the Institute, and said he felt sure that the meetings would be well attended.

Presidential Address

In thanking the members for his selection, he expressed the pleasure he felt at being able to address the members as a practical foundryman.

He continued by voicing his regret at the present state of affairs on the Tyneside. Looking back 38 years ago, when serving his apprenticeship at the well-known works of Messrs. Robert Stephenson & Company, then situated on the Tyne, he could not help but draw comparisons between then and now. Tyneside was amongst the busiest and most prosperous districts in the country, and it was sad to think that now the majority of the works were no more. At that time, too, first-rate castings were produced under very different conditions from those pertaining to the present day. Moulders were often handicapped by lack of educational facilities, many of the men being unable either to read or write, but they were amongst the finest craftsmen in the country.

Concerning the present stagnation, he looked for a reason, and felt that high rating valuations on both sides of the Tyne were partly responsible. In addition, do the managements in the industry look forward into the future? To meet with competition plant must be modernised, and it is doubtful if this has been done to the fullest extent.

Free Land for New Industries

Would it not be better for the district to offer an inducement to industry in the form of land free of rates, for a given period of, say, two to three years? Such a method would at least give an impetus to employment of the craftsmen now out of work. Why was there no malleable foundry in the district? What is wrong with the steel foundries? There was no good reason why Tyneside should have to go elsewhere for steel castings at a cheaper rate than they could be produced on the spot. It was well realised that the foundry industry had gone through a lean time on the Tyne. This was partly due to the depressed state of the shipbuilding industry, which has helped to cripple those foundries which were wont to rely upon marine-engine castings. It was unnecessary to have one's eggs in one basket. Business is to be obtained, but it must be looked for, and it was essential to get down to competitive prices.

Returning to the question of the moulders, it was questionable whether the moulder of the future was being trained in the best way in this area. It should be practicable for every foundry to employ a practical moulder to instruct and interest the boys in their work, and to impress upon them the benefits to be obtained from attendance at the foundry classes at the technical colleges. It was certain that the progress made by the boys under such a scheme would more than pay for the practical moulder in a very short time. A small money prize might be given each session to the boy who made the most satisfactory progress. This would help to buy the tools requisite to the trade, and in most cases apprentices were not in the position to spend a great deal upon their tools.

By attention to these questions, there would be no need to fear for our future moulders, or the lapse of the foundry trade on the Tyneside.

Local Industries Require Modernising

It was only after the outbreak of the war that the authorities realised where real skill was required in the manufacture of munitions. That was in the foundry. Up to then, foundries were looked upon as dirty, undesirable places in which to earn a living. They ought to be places to be proud of, and we should do our best to make them so in the future. It should be possible for foundrymen to go to their work, and leave it, in their normal clothing. The provision of lockers, wash basins, and similar conveniences, would go a long way to help. We are really a long way behind the times in this respect, as such equipment was provided in some foundries twenty-five years ago. Give the moulder better conditions; treat him fairly in return for his craftsmanship, and there is no more honest class of workman anywhere. There is no doubt that, if we are to keep up with the times, the foundry owner will have to see that his foundry is kept up to date in this respect, and also in regard to equipment and scientific and practical metallurgical knowledge.

All of these bear upon production, with accompanying difficulties, which naturally arise. At the Branch meetings, it should be possible to thrash out any problems which may arise, and thus pave the way to new and quicker methods of production. That is what the Institute of British Foundrymen stands for—the solution of problems by the reading of Papers and delivering lectures, which create discussions for the betterment of the foundry trade as a whole, throughout the country, both scientifically and practically.

The Tyneside craftsmen are amongst the best in the world, and the foundry trade in the district should show the way back to prosperity, so that such men should not lose confidence in themselves, as they must do if they remain unemployed. Work is to be obtained by going out for it. Too much reliance has been placed on one or two specialities. Foundrymen should be prepared to take anything that offers, and, if a concerted effort were made, conditions could be improved considerably, and many of the unemployed moulders would be at their jobs.

Mr. Robson concluded by saying that, if his efforts had the effect of enrolling a record number of new members, he would be more than gratified.

Vote of Thanks

Mr. W. Scott, in proposing a vote of thanks to the President, associated himself completely with the remarks made. Regarding the training of apprentices, he wondered whether the right type of boy was being influenced to take up foundry work. The method advocated by the President had been tried to his knowledge, with moderate success only. The boys showed interest, and the moulder deputed to train them carried out his work efficiently. A bonus payment had been arranged each week, but he felt that complete success was not possible, unless boys of sound education were obtained. Unfortunately, it was a fact that many boys were of indifferent education, and in the foundry, where, as the President had stated, skill was required, it was essential to attract the right class of apprentice.

He agreed that foundry conditions were not always of the best, and hoped to see the day to which the President had referred, when all facilities would be provided for the foundry worker for his personal welfare.

New Tungsten Mine in Rhodesia

A new tungsten mine has been opened up in the neighbourhood of Wankie, Southern Rhodesia, and is now working at the rate of 12 tons a month. The ore contains about 70 per cent. W and occurs as pebbly lumps up to 2½ in. in dia. Developments have progressed rapidly and further extensions are expected shortly. Output of tungsten ore in the Union of South Africa and Rhodesia has been very small since the industry commenced in 1919, the production in 1932 being only 14 tons.

Unhealthy Spelter Situation

By "Onlooker."

With the exception of tin, which keeps stable at an inflated price as the result of the schemes of control at present in force, the base metals have lately made a very poor showing and at present give no signs of climbing out of the rut into which they have fallen. There was a time when spelter was dubbed the Cinderella of the metal markets, but the quotation climbed high enough during the post-war years to permit of a change of sentiment in regard to this metal. Events during the present year have, however, put the clock back again, for from a price of about £18 10s. not much more than eighteen months ago the quotation has crumbled away to slightly below £12!

In considering the spelter situation one can really leave the United States out of the picture, for the price over there is inflated by virtue of the tariff, and the general parity is therefore well above the London level. American brands, which formerly found their way across the Atlantic, are no longer seen on this side, and it is even doubtful whether the fluctuations in the cent price have much effect on the London market. Outside the U.S.A. spelter "politics" are mainly controlled by the Zinc Cartel, which numbers amongst its members the producers of Canada, Australia, Germany, Belgium and this country. Reports are now current that the cartel is in danger of breaking up, as it is fairly obvious that Germany will withdraw, for there is no particular reason why she should remain in this producers' pact. A breakdown of the present selling arrangements may occur, but there seems to be no reason why the remaining producers should not hang together, and in any case it is hard to believe that anything that may occur now will put spelter much lower.

On reviewing the spelter situation over the period since early 1932, when the 10 per cent. duty was first levied, one cannot help feeling that the Empire producers, in whose interests this tariff was arranged, must have wished the days of free trade back again, for on balance the tendency has been always towards a lower level. Month after month the declarations of foreign spelter on the London Metal Exchange have brought about a further sag in values, for the warrant market offers no attraction to consumers to-day and their purchasing is done in the form of Empire brands on the open market.

Here, however, a fresh complication arises, for not only are users of zinc being compelled to pay onerous premiums on every ton of Empire metal they purchase, but they are faced with a scarcity of supplies which amount almost to a famine. That this state of affairs should have been allowed to develop without a strong protest being lodged with the Board of Trade is amazing, for the present situation illustrates the danger of levying a duty on essential raw materials and is absolutely contrary to the spirit in which preference for the Empire was granted. It is common knowledge that consumers are disgusted at the manner in which they are being exploited, but so far no kind of approach to the Government appears to have been made.

One result of this scarcity of duty-free spelter and the exorbitant price demanded for it, is that a certain amount of foreign metal has been withdrawn from bonded warehouses and passed into consumption on payment of the 10 per cent. tax. If nothing is done to alleviate the difficulties of the present situation this withdrawal of foreign metal may continue, and since recent statistics show that out of total warehouse stocks of about 11,000 tons some 8,000 tons are in bond, the shortage can be corrected—at a cost.

XUM

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Mechanisation; Hand Production and Output

To the Editor of The Foundry Trade Journal.

Sir,—In the first part of a thesis on the rôle of box parts in quantity production, in your number of August 9, 1934, page 89, some comments are made on mechanisation which are contradicted by the results in our foundry. While fully realising the risk of over-mechanisation, we nevertheless possess evidence that the application of simple, cheap gravity conveyors for conveying the moulding boxes from moulding machines to pouring station and the empty boxes back to the moulding machines introduces considerable saving of time and wages.

Our mechanisation of the last three years—sand conveyors from the knock-out to the automatic reconditioning plant and from there to the hoppers above the moulding machines, and a conveyor for transferring the castings to the sand-blast plant—has (*a*) doubled the number of moulds per moulder and (*b*) eliminated almost all general labour formerly necessary for the conveyance of castings, boxes and sand.

The pecuniary gains from (*a*) and (*b*) greatly exceed the interest and depreciation of the plant plus cost of supervision and maintenance.

In the article of August 9 the writer further says: "As is well known, castings are being made by hand to-day at production figures which no moulding machine can approach. Railway chairs provide a case in point."

Now we make railway chairs 14 in. by 7 in., $2\frac{3}{4}$ in. high, with six cores each, two in a set of boxes 17 in. by 16 in. by 2 in. by 6 in.; we make them on a pair of pneumatic moulding machines in the plant described above.

Two moulders and one labourer together regularly produce 41 moulds of two chairs, *i.e.*, 82 chairs an hour, and the writer would like to know if in the opinion of the writer of the article of August 9 such a number ever has been, or can be, attained by hand.—Yours, etc.,

The Manager of a Continental Foundry.

Tin Oxide Substitutes

To the Editor of The Foundry Trade Journal.

Sir,—With regard to the Paper prepared by Mr. England for the first Annual Conference of The Institute of Vitreous Enamellers, held in Birmingham from September 28 to 30, whilst expressing the appreciation of the writer on the excellent *résumé* of the history of the vitreous enamelling industry, I hope it will not be out of place, as it was not possible for obvious reasons, to make such a criticism during the course of the lecture, to point out that Mr. England no doubt intended to provoke criticism in stating that he had no use for substitutes for tin oxide.

We are, of course, uncertain whether he was referring strictly to substitutes or comparable opacifiers, but we feel that his reference to titanium and zirconium compounds not having the opacifying power of tin oxide, bears some serious correction.

Dealing with titanium oxide, it is agreed that titanium would never be recognised strictly as an opacifier to replace tin oxide, nor has it ever been claimed to have this virtue, as it has very little opacifying value; it is, however, definitely the most wonderful aid, if properly used, in balancing an enamel glaze or glass enamel; at the same time, it gives strength to any frit or enamel in which it is incorporated, and, when used in conjunction with zirconium oxide, it definitely represents a result as yet unequalled in ceramic technique.

With regard to zirconium compounds, it may not be generally known that during the past twenty years the Titanium Alloy Manufacturing Company, of Niagara Falls, New York, has put most intensive research into the application of zirconium compounds in frit and glaze formulations, covering sheet and cast-iron and clay-body research, with the result that the proprietary produce of the above producers, sold under the name of Tam Opax, does undoubtedly replace tin oxide pound per pound, and, further, Tam Opax (zirconium oxide) is inert, does not enter into solution, does not easily take up fumes in the muffle, is not subject to black specks, is stable or foolproof against over-firing due to its inert properties, and is not inclined to cause chipping at corners of plates or utensils. Lastly, its colour does not vary, having great resistance to the enamel colour, thus giving stabilised colouring value.

Our experience has been that for certain purposes zirconium is definitely preferable to tin oxide, but certainly for other specific uses, such as hollow-ware, tin oxide still holds the field as the best opacifier.

With these obvious comparisons between various opacifiers, it is quite safe to say that Mr. England's remarks in his lecture, where he said, "to have nothing to do with substitutes unless the composition is given," is definitely misleading, provided, of course, that the substitute or replacing opacifiers purchased are obtained from reputable suppliers.

We venture to hope that these comparisons will help the enamelling trade to look upon titanium and zirconium products in the correct perspective.—Yours, etc.,

W. Astles, Director,
The Union Oxide & Chemical Co., Ltd.
1-2, Pepys Street, Seething Lane, E.C.3.
October 5.

Routine Analysis of High-Sulphur Steels

To the Editor of The Foundry Trade Journal.

Sir,—May I take this opportunity of thanking Mr. Tucker for his instructive comments on my article of August 2?

I agree that it is very advisable to standardise the iodine against steels of varying sulphur content, as each operator should obtain his own factors. Mr. Tucker will find I suggested this: the factors I gave are those which I find give reasonably correct results for my own work. A difficulty in this connection lies in the scarcity of high-sulphur standard steels: I do not know of any such steel which is on the market.

Regarding the suggested loss of H_2S on acidifying, I emphasised the importance of working with dilute solutions, to minimise this danger. An improvement would be to pour the solution and precipitate into the basin, and dilute before acidifying. This should be a sufficient precaution, if the solution is not allowed to become warm (by the bubbling of steam at the end of the evolution). This method has the advantage of employing one standard solution only, as against two using Mr. Tucker's modification.

The point of using hot acid is, I presume, to ensure a rapid evolution of H_2S. This is often recommended, but, in practice, I have obtained the same results by a fairly rapid heating from cold.—Yours, etc.,

Leonard D. Hewitt.
171, Copster Hill Road,
Oldham.
October 4, 1934.

Industrial Research Advisory Council

It is announced that Sir John Cadman and Sir James H. Jeans have been appointed members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research. Sir Arthur Balfour, Bt., Sir William H. Bragg, and the Rt. Hon. Lord Rayleigh have retired from the Council, having completed their terms of office.

New Trades School Opened in Glasgow

The new trades school which has been built by the Education Committee of the Corporation of Glasgow, at a cost exceeding £160,000, was formally declared open by Sir Godfrey Collins, Secretary of State for Scotland, on September 26. The school is a five-storey building situated in Shamrock Street, Garnethill.

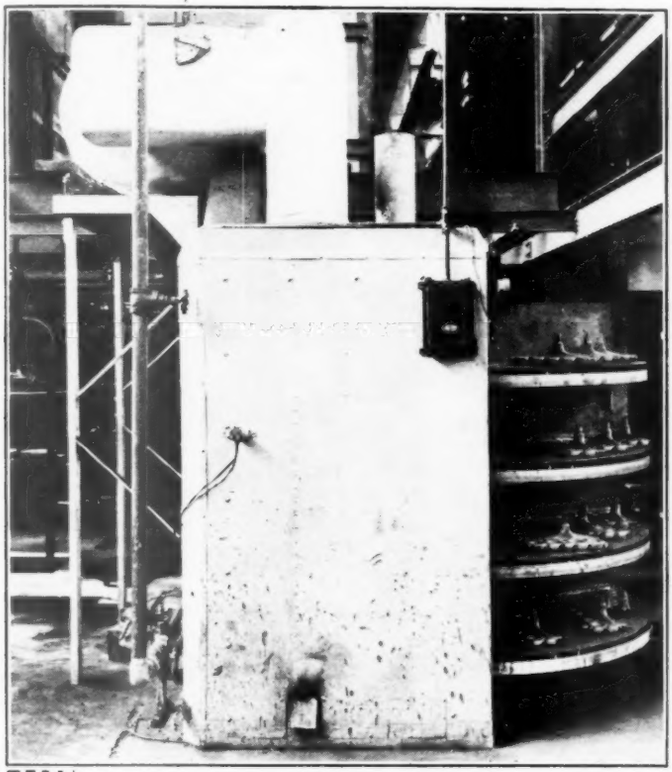
At the opening ceremony, River Bailie John M. Biggar, Convener of the Education Committee, who presided, was accompanied on the platform by Mr. W. W. M'Kechnie, secretary of the Scottish Education Department; Mr. R. M. Allardyce, Director of Education; Mr. David Stenhouse, Town Clerk of Glasgow; Sir Charles Clelland, a former Convener of the Education Committee; Mr. E. Rosslyn Mitchell, Convener of Continuation Classes Sub-Committee; Mr. A. Mitchell, Dean of Guild; Mrs. Swan, wife of the Lord Provost; Mrs. Biggar; Prof. Coomack, Glasgow University; and the Rev. Robert Daly.

The chairman explained that the building formed only a part of the Corporation's scheme for the training of trade and craft apprentices. They would require at least two more such buildings to enable them to fulfil their duty to all the youth of the city. The present building was devoted to the engineering and allied trades, twenty-three in all. Already in other buildings in the city they provided for other trades. Great attention had been paid in the designing of the new college to the question of future developments, so that workshops could be adapted without much trouble or great expense. The new building provided accommodation for over 1,000 students per evening, and, although enrolment had only just commenced and some classes were not yet in operation, they had already more than 1,200 students enrolled. He had pleasure in calling upon Sir Godfrey Collins to declare the building open.

Sir Godfrey Collins said trade classes were nothing new in Glasgow; they had existed for 140 years. John Anderson, Professor of Natural Philosophy, started them in 1796, in a building which came to be known as the Andersonian College, and which was the starting point of their present Royal Technical College. It was by a happy coincidence that another John Anderson, their Deputy Director of Education, had been the moving spirit in their organisation of trade classes. That the numbers attending them had increased from 900 to 5,500 in the last 14 years was a striking tribute to the value and success of the work. It was also a tribute to the spirit of the young people who came forward voluntarily, and in many cases after an arduous day's work.

Sir Godfrey Collins, in referring to the system of Advisory Committees and the valuable work they performed, made a strong appeal to the leaders of industry to give all possible help to the educational work of the Corporation and of other institutions, such as the Royal Technical College, the College of Art, the Commercial College and the College of Domestic Science. The most generous grants of money from the Central Government were unavailing unless in the locality itself there was public interest and support, local pride and local criticism. These were the indispensable conditions of real success. He had the greatest pleasure in declaring the college open, and expressed the most earnest hope for its success and that students would soon find suitable posts for the display of skill they acquired within its walls.

After the ceremony the large audience inspected the various workshops and classrooms in the college. Included in the equipment is a foundry and patternshop, a detailed description of which will appear in a future issue.



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This Week's News in Brief

Trade Talk

NI-RESIST has been used for the impellers of the four main pumps of the King George V graving dock at Southampton.

BUILT BY Messrs. Vickers-Armstrong, Barrow, for the British Admiralty, the new submarine "Severn" has arrived in the Clyde to carry out trials.

MESSRS. HARLAND & WOLFF, LIMITED, Belfast, have received an order for a passenger ship of about 11,000 tons from a well-known Empire company.

HURST, NELSON & COMPANY, LIMITED, Motherwell, have secured a contract for bogie frames, and the Scottish Iron & Steel Company, Limited, one for rolled sections.

THE FIRST RIVET in the keel of a new cruiser to be built by Vickers-Armstrong, Limited, at the Walker Naval Yard, was put in this week by Commander C. W. Craven, a director of the firm.

GREAT INTEREST is being taken in the new L.M.S. Leyland rail coach which is running between Hamilton and Brockelbrae. The coach is driven by oil. As the engine is entirely under floor, all of the car body is available for passenger seating.

WILD-BARFIELD ELECTRIC FURNACES, LIMITED, of Elecfurn Works, North Road, Holloway, London, N.7, have changed their telephone numbers to North 3082 and 3083. The London works of their associated company, G.W.B. Electric Furnaces, Limited, have also the same telephone numbers.

MESSRS. G. & J. WEIR, LIMITED, Cathcart, Glasgow, are testing the first of the small autogyros which are being built at their works in the West of Scotland. Not only has this firm designed the frame of their autogyro, but they have also developed an entirely new 45-h.p. engine for use with this machine.

ORDERS WHICH WILL KEEP the firm busy until the end of the year have been secured by Messrs. F. D. Cowieson & Company, coach builders, St. Rollox, Glasgow, for omnibuses to be of the latest approved pattern, consisting largely of steel. Messrs. Cowieson, for this Belfast order, competed with famous English firms.

A CONTRACT FOR A high-class cargo liner has been placed by Manchester Liners, Limited, with the Blythswood Shipbuilding Company, Limited, Scotstoun. The vessel will have a length of about 430 ft. and a beam of about 57 ft. Messrs. David Rowan & Company, Glasgow, will supply the propelling machinery.

THE PASSENGER LINER "Empress of France," owned by the Canadian Pacific Railway Company, has been purchased by Messrs. Turner & Hickman, Glasgow, for Messrs. Arnott, Young & Company (Shipbreakers), Limited, Dalmuir, for breaking-up purposes. This vessel, which has a gross tonnage of 18,500, was one of the most noted passenger liners of her day.

DURING THE TWELVE MONTHS ended June 30, 1934, Canada's imports of iron and steel and products thereof were valued at $83,773,229, as against $54,012,048 a year ago. Imports from the United Kingdom this year rose from $12,328,433 to $17,740,985, whilst imports from the United States rose also from $28,868,671 to $62,449,971.

MORE SALVAGE in Scapa Flow began this week, when Metal Industries, Limited, Glasgow, tackled the German battleship "Konig Albert." Divers also examined the battleship "Kaiserin," but the "Konig Albert" was selected for operations. The battleship lies in 20 fathoms of water, with 13 fathoms over her bottom, at the north end of Scapa Flow, but is not so deep as the "Bayern" was.

MR. F. J. CREE has established himself in business at 22, Prospect Avenue, Rochester, as supplier of foundry raw materials. Amongst other materials handled are refractories of all kinds, including ganister, fireclay and cements, moulding sands, and silica sands and cold-blast cylinder irons. Mr. Cree, it will be remembered, has occupied the position of foundry manager to some of the largest foundries in the Midlands and South of England.

THE BUILDING of the new factory of the recently-formed Swedish Aluminium Company, at Mansbo, near Avista, has been completed. The 46 smelting furnaces have been installed, and it was hoped that the factory would be ready for work this week. The plant will obtain its electrical energy from the recently-completed power plant of the Alby New Chlorate Factory at the Avesta Falls, but the raw materials for the manufacture is to be sent from the plant of the Norwegian Aluminium Company at Hardanger, in Norway.

IF THE NECESSARY SAFEGUARDS can be obtained, the Union Steamship Company, of New Zealand, Limited, are prepared to place an order in Great Britain for a very large and modern steamer, which will be capable of carrying passengers across the Tasman from Auckland to Sydney in 60 hours. Mr. N. S. Falla, managing director of the company, who made this statement in New Zealand, repeated it here, when he arrived by the company's Pacific liner, "Aorangi." The "Aorangi" was built by the Messrs. Fairfield Shipbuilding & Engineering Company, Limited, of Govan.

AS A RESULT of the biennial elections of officers of standing committees of the American Society for Testing Materials, several new officers have been chosen to direct the activities of certain committees. The names of the officers of the Committee A.3 on Cast Iron are:—Chairman, Mr. Hyman Bornstein, Director of Laboratories, Deere & Company; vice-chairman, Mr. W. H. Rother, metallurgist, Buffalo Foundry & Machine Company; secretary, Mr. E. K. Smith, metallurgist, Electric Metallurgical Company. Members of the committee are conducting an extensive series of investigations on test-bars, involving methods of making, correlation of test-bar size and controlling section as shown in the specification for grey-iron castings, and, when the final report is made, desirable changes will be proposed in the specifications. A standardised impact-testing machine is being developed. Results with this machine should indicate the possibility of formulating a standardised method of impact testing for cast iron.

The Pipe Foundries of the Staveley Coal & Iron Company, Limited

(Concluded from page 226.)

The wood-wool department was originally laid down to supply the demand of the core shops of the pipe foundries and in so doing to turn to profitable account broken pit props. An outside market for the product developed very rapidly, however, and whilst the old pit props are still used up, they provide but a small percentage of the timber required to feed the seven ripping machines and the six wood-wool rope twisters which are now installed. The present output is approximately 600 bales per week over and above works' requirements.

There are well-laid-out and equipped shops for the maintenance of the cottage property owned by the company, a staff of 30/40 being employed to take care of upwards of 5,000 houses. This staff is responsible for the maintenance and to a large extent also for the manufacture of the office furniture of the company. The works are served by a network of standard tracks with sidings communicating directly with the main lines of the L.M.S. and L.N.E. Railways. The normal stock of pipes carried on the storage gantries is 12,000 tons, though storage capacity is provided for upwards of twice that tonnage.

The roads are well made and they are well kept, the management showing a real appreciation of the fact that even a very old works need not be dirty or even untidy. There is everywhere evidence of the orderly cleanliness which is characteristic of each and every one of the Staveley undertakings.

Obituary

THE DEATH OCCURRED recently of Mr. Peter Carmichael Davie, the sole partner in the old-established Stirling firm of James Davie & Sons, ironfounders and engineers. Mr. Davie, who was 56 years of age, was preparing to leave for the foundry in the morning, when he had a seizure, and died immediately. The foundry, established in 1857, has held a reputation for good, solid work, and has carried out many large contracts.

Personal

MR. J. LONGDEN, foundry foreman at Messrs. D. & J. Tullis, Clydebank, has presented the Clydebank public library with a piece of sculpture work. The work, which is his own, is entitled "The Sprinter," and shows the runner in action. It has been placed in the hall of the library.

MR. WILLIAM ROACH, who, for the past 47 years, has been manager of the Gloucester branch of Messrs. R. A. Lister & Company, Limited, of Dursley, has retired. On the occasion of his retirement he was presented by the firm with a clock. Mr. Roach worked under three generations of the Lister family. His first "chief" was the late Sir Ashton Lister, the founder of the firm.

ON THE OCCASION of his leaving Durie Foundry, Leven, Mr. E. E. Geisinger, who has been associated with Mr. W. Lindsay Burns, as joint managing director of the new works of Enamelled Metal Products Corporation (1933), Limited, acted as host to the staffs of that concern and of Henry Balfour & Company, Limited, in Lundin Links Hotel. The staffs took the opportunity of presenting Mr. Geisinger with a parting gift in the form of a fitted travelling case.

Contracts Open

Swansea, October 26.—400 cable boxes and 28,300 ft. of cable, for the new power station at Tir John. Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, Westminster, S.W.1. (Fee £5 5s., returnable.)

Argentine, October 25.—8,700 cast-iron, steel and brass valves, comprising sluice valves, globe valves, safety valves and check valves, also about 2,400 brass cocks, taps, etc., for the State oilfields. The Department of Overseas Trade. (Reference G.Y. 14,334.)

Burwardsley, October 18.—Provision, laying and jointing of about 7 miles of cast-iron and asbestos-cement water pipes, 3 in. and 2 in. dia., for the Tarvin Rural District Council. Mr. H. Grant Bailey, clerk, Council Offices, Westminster Buildings, Newgate Street, Chester. (Fee £5 5s., returnable.)

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Atlas Malleable & General Iron Works, Limited, Atlas Foundry, Ablewell Street, Walsall.—Capital £5,000. Ironfounders. Directors: P. S. Hanafy and F. G. Harris.

Kaye Alloy Castings, Limited.—Capital £5,000. Manufacturers of and dealers in metal castings. Directors: E. S. Kaye, 43, Brook Lane, King's Heath, Birmingham; E. I. Lister.

W. & S. Allely, Limited, 20, Key Hill, Birmingham.—Capital £4,000. Manufacturers of ferrous and non-ferrous metals, castings, etc. Directors: W. S. Allely, S. W. Allely, Doris Allely and H. V. Allely.

Liverpool Art Metals, Limited, 33, Everton Brow, Liverpool.—Capital £100 in £1 shares. To carry on business as iron and brass founders, etc. Directors: M. W. Kuhn, 84, Grove Road, Wallasey, Ches.; G. Orford, 11, Gwydrin Road, Calderstones, Liverpool.

Forthcoming Events

Institute of British Foundrymen

OCTOBER 12.

Middlesbrough Branch:—Presidential Address and Reception at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.45 p.m.

OCTOBER 13.

East Midlands and Sheffield Branches:—Joint meeting. (1) Visit to the Broad Oak Works of Messrs. Markham & Company, Limited, Chesterfield; (2) "Foundry Methods from an Engineer's Point of View," Paper by F. Williams.

Scottish Branch:—(1) Presidential Address; (2) "The Position of the Designer and Patternmaker in Relation to Foundry Practice and Competitive Methods of Producing Castings," Paper by A. L. Mortimer (John Surtees Gold Medal Paper, 1934), at the Royal Technical College, George Street, Glasgow, at 4 p.m.

West Riding of Yorkshire Branch:—(1) Presidential Address; (2) Open discussion on "Modern Foundry-Sand Practice," introduced by F. K. Neath, B.Sc., at the Technical College, Bradford, at 6.30 p.m.

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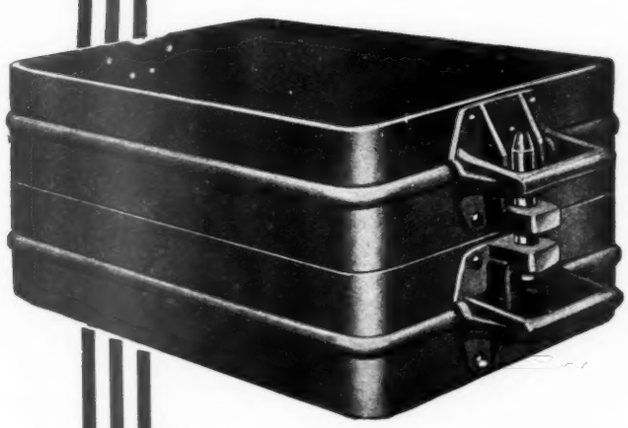

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BEDFORD

Raw Material Markets

Iron and steel manufacturers are generally maintaining their outputs, without having to make any additions to stocks, this indicating that a sufficient market exists for the current output. New orders for pig-iron have not been very brisk, but this is sufficiently explained by the large number of consumers who have entered into forward contracts.

Pig-Iron

MIDDLESBROUGH.—The opening of a new quarter has not brought any animation to the demand for Cleveland foundry iron. There is, however, a regular flow of specifications against running contracts, which, supplemented by occasional prompt sales, suffices to absorb the output. Export business is still very limited. The news that preparations are being made for restarting an additional blast furnace in this area before the end of the year is evidence of the producers' faith in the future of the market. Prices of No. 3 Cleveland G.M.B. to Scottish buyers are 67s. 3d. delivered Falkirk and 70s. 3d. delivered Glasgow, which compares with a delivered price of 67s. 6d. in the Middlesbrough area and 69s. 6d. per ton elsewhere on the North-East Coast. No. 1 foundry grade remains at a premium of 2s. 6d. per ton and No. 4 foundry and No. 4 forge irons are 1s. cheaper than No. 3. These, of course, are all home quotations. Export prices are well below these figures, being free from control.

East Coast hematite continues to be in strong demand. The producers state that orders on the books ensure a continuance of this satisfactory state of affairs beyond the year end, although new business has recently fallen away in those areas where price increases were recently made. Current quotations for No. 1 East Coast hematite are now 69s. per ton delivered Middlesbrough, 71s. delivered North-East Coast, 75s. to 78s. delivered Yorkshire, 75s. delivered Scotland (by rail), 76s. delivered Lancashire, 79s. delivered Birmingham, and 83s. 6d. delivered London by rail or 69s. 6d. f.o.b.

LANCASHIRE.—Most branches of the pig-iron consuming trades in this area continue to be satisfactorily engaged, and the Midlands blast furnaces report the fixing of contracts to cover supplies of iron for the next four or five months. Delivery specifications to hand so far this month have been quite promising, and there is a general feeling that October deliveries will show a return to the level which ruled in the first half of the year, before holiday influences made themselves felt. Values are steady, with offers of Staffordshire, Derbyshire and Lancashire No. 3 equal to Derbyshire all quoted for delivery to users in the Lancashire zone on the basis of 74s. per ton. Northants and Lancashire iron equal to Northants being at 72s. 6d., Derbyshire forge at 69s. to approved users, and Scottish foundry at about 82s. 6d. The demand for hematite in this area continues on a relatively quiet scale, with East Coast brands ranging from 75s. to 76s. per ton, according to quality. West Coast iron for delivery to Manchester users is offered at the lower rate of about 78s. 6d. per ton.

MIDLANDS.—A rather more optimistic feeling prevails in this market. Delivery specifications for pig-iron have been coming forward more freely lately, and the makers are well booked forward, in some cases foundries having covered into the first quarter of 1935. Prices remain at 67s. 6d. per ton for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffs No. 3, including delivery to Birmingham and Black Country stations, and plus 11d. for delivery to works in 10-ton lots. Scottish No. 3 and low-phosphorus brands are quoted at between 85s. and 87s. 6d. delivered, medium-phosphorus pig from 72s. 6d. to 80s., and highest-class cylinder pig-iron for motor-car, Diesel-engine and similar work is quoted at £5 10s. to £6 15s.

SCOTLAND.—The demand for Scottish foundry iron is quiet and featureless. Quotations continue at the official minimum of 70s. f.o.t. furnaces for No. 3, with 2s. 6d. per ton extra for No. 1. The light-castings manufacturers remain very active and there is a strong call for Cleveland iron, quoted at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow for No. 3 foundry. Other English irons are offered at slightly below these figures.

Coke

The foundry-coke market maintains its firmness, especially as the time is now approaching when an expanding demand for heating purposes may be expected. Quotations for delivery in the Midlands remain at 30s. to 40s. for best Durham coke, 37s. 6d. to 45s. for Welsh coke and 40s. to 41s. per ton for Scottish coke.

Steel

Business in the steel markets has been maintained, and in some branches it shows a noticeable tendency to expand. Business in the semi-finished steel department has been moderately active; but of late few forward contracts have been placed, consumers for the most part preferring to cover their requirements as they arise. Continental works continue to quote competitive prices in the British market, but have not been successful in obtaining many orders, the great bulk of the business having been placed with the British makers. Encouraging conditions rule in the market for finished steel materials, and, although there is some irregularity in the demand in most departments, production is on a good scale. The greater part of the output is absorbed by the home market, and export trade is still restricted.

Scrap

In the Cleveland area, there is a good demand for ordinary heavy cast-iron scrap and machinery metal, but quotations are unchanged at 50s. and 52s. 6d. per ton respectively. There is a consistent demand for scrap-iron in the Midlands, where prices remain at the old levels. In South Wales, there is a steady demand for heavy cast iron in large pieces and furnace sizes at 47s. 6d. to 48s. 6d. per ton, and for light cast-iron scrap at 41s. 6d. to 42s. 6d. There is only a limited call for machinery scrap in this area, and business is restricted to a few truckloads at about 52s. 6d. per ton. In Scotland, machinery cast-iron scrap in cupola sizes, pieces not exceeding 1 cwt. is at 54s. to 55s., with ordinary cast iron to the same specification at 51s. 3d.

Metals

Copper.—At the time of writing, the price of standard copper on the London market has fallen to £25 12s. 6d., the lowest price reached this year, comparing with the lowest price reached during 1933 of £27 3s. 9d. per ton. As yet there is no promise of any definite recovery being made. There has been a moderate demand from consumers in this country, but business with Continental consumers has been unsatisfactory. The recent trend of the United States copper trade has also been distinctly discouraging. Rumours continue to prevail that producers of this commodity are being forced to consider some measure of co-operation, in the endeavour to check the downward fall of values. It certainly seems as if nothing short of international restriction of production will lift the market out of its present rut.

Daily market prices :—

Cash.—Thursday, £25 13s. 9d. to £25 16s. 3d.; Friday, £25 16s. 3d. to £25 17s. 6d.; Monday, £25 18s. 9d. to £26; Tuesday, £25 16s. 3d. to £25 17s. 6d.; Wednesday, £25 12s. 6d. to £25 13s. 9d.

Three Months.—Thursday, £25 18s. 9d. to £26 1s. 3d.; Friday, £26 2s. 6d. to £26 3s. 9d.; Monday, £26 3s. 9d. to £26 5s.; Tuesday, £26 2s. 6d. to £26 3s. 9d.; Wednesday, £25 17s. 6d. to £25 18s. 9d.

Tin.—The fact that the value of tin remained firm whilst all other base-metal prices were weakening sufficiently illustrates the tightness of supplies upon the London market. This stringency is likely to become more pronounced as the winter advances, and the effect of the latest cut in production becomes more fully felt.

"Trade demand has been quiet with little inquiry both in this country and on the Continent, and business in the United States of America continues on a very limited scale. Metal for near delivery has been offered more freely. Having in view the uncertainties with which the general outlook is surrounded, the future course of prices is difficult to determine; confidence has been disturbed by the unsettled conditions prevailing in other markets, and were it not for the control which is exercised over production, prices would no doubt have weakened in sympathy," report Messrs. Rudolf Wolff.

Price fluctuations :—

Cash.—Thursday, £230 to £230 5s.; Friday, £230 15s. to £231; Monday, £230 10s. to £230 12s. 6d.; Tuesday, £230 15s. to £230 17s. 6d.; Wednesday, £230 5s. to £230 10s.

Three Months.—Thursday, £228 10s. to £228 15s.; Friday, £228 10s. to £228 12s. 6d.; Monday, £228 10s. to £228 12s. 6d.; Tuesday, £228 10s. to £228 12s. 6d.; Wednesday, £228 12s. 6d. to £228 15s.

Spelter.—The price of spelter has rallied slightly, after having fallen to the lowest level reached since 1932, but prospects of further improvement are not very good at the moment. The London market continues to experience the depressing effect of heavy imports of Continental metal. In view of the present situation, it is not surprising that rumours continue to circulate of dissention within the ranks of the International Zinc Cartel—the producers' association. The efforts of Germany to foster a native spelter industry are making things very difficult.

Day-to-day quotations :—

Ordinary — Thursday, £11 15s.; Friday, £11 17s. 6d.; Monday, £12; Tuesday, £12; Wednesday, £11 15s.

Lead.—The consumption of lead in this country continues to keep up at quite a good level.

In their weekly report, Messrs. Brandeis, Goldschmidt say: "Lead has not been so depressed as the other metals and, although the price has fallen slightly, the undertone is still fairly good. There has been rather less buying by consumers in this country, but the price is now so low that there is little inducement for users to hold off in the expectation of covering more favourably."

Price fluctuations have been as follow :—

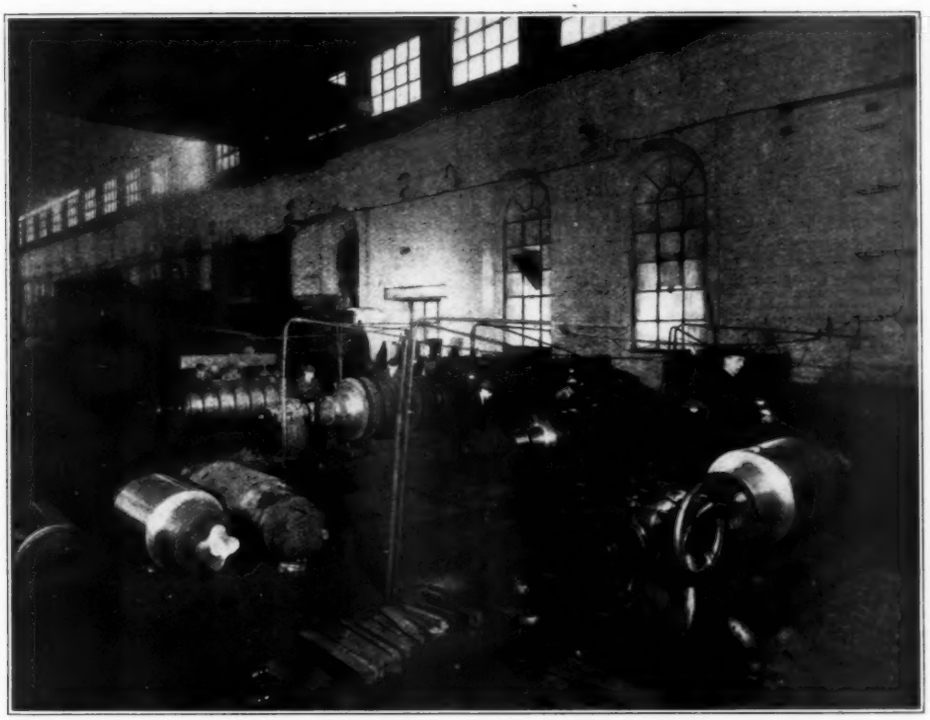
Soft Foreign (Prompt).—Thursday, £10; Friday, £10 3s. 9d.; Monday, £10 6s. 3d.; Tuesday, £10 3s. 9d.; Wednesday, £10 3s. 9d.

Catalogue Received

Electric Furnaces. The General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, have prepared a 32-page booklet which very comprehensively covers the field of electric furnaces from simple treatment work to steel melting by either the high-frequency or the arc-electrode methods. The heat-treatment furnaces are nowadays provided with gas circulation as stewing in stationary air is no longer considered to be efficient. The G.E.C. furnace designers have been particularly successful in the provision of mechanical-charging methods, and several of the arrangements illustrated are exceedingly well-arranged devices, including bogies, car-type hearths, pusher-type furnaces. One illustration which interested us appears on page 21, and shows a large-size electric-resistance furnace for melting aluminium, whilst on the next page a well-designed vitreous-enamelling furnace is depicted. Where electricity can be bought at a reasonable price, there is much to commend the electric furnace on the dual grounds of cleanliness and temperature control. Another foundry application is covered by a range of furnaces which is typified by the one illustrated on page 24. It is equally applicable to core-mould drying, stove enamelling and japanning. The last few pages cover melting, and the Witton high-frequency (Stobie) electric furnace and the G.E.C. Brown-Boveri arc furnace, fitted with electro-hydraulic automatic electrode control, are both dealt with. It is a well-produced pamphlet and is available to our readers on request.

AN EXCELLENT MOULD DRESSING to use when casting copper billets can be made from the following: Three parts lard oil, two pounds of tallow, one pound of China clay, half-a-pound of French chalk; add sufficient finely-powdered charcoal to bring it to a treacly consistency. This should be applied to the surfaces with a mop made of tow.

BRITISH ROLL FOUNDRIES



Section of Roll Turning Shop of Messrs. C. AKRILL & CO., LIMITED, WEST BROMWICH, regular users of

GENUINE
COLD BLAST PIG IRON

The continued use of Genuine Cold Blast Pig Iron, despite modern innovations, is a certain proof that it possesses properties not to be found to the same high degree in any other Pig Iron. This

superiority lies chiefly in its remarkable homogeneity, greater strength and better wearing qualities, which are not lost on remelting in the cupola or air furnace, but persist right through to the castings made.

THE EARL OF DUDLEY'S ROUND OAK WORKS, LTD.
BRIERLEY HILL, STAFFS.
Brand: "DUD·L.N.F'ces·DUD"

M. & W. GRAZEBROOK, LIMITED
DUDLEY, WORCS.
Brand: "GRAZEBROOK"

THE LOW MOOR IRON CO., LTD.,
NEW WORKS, LOW MOOR, BRADFORD - YORKSHIRE
Brand: "LOWMOOR C.B."

XUM

RAW MATERIALS—PRICE LIST

(Wednesday, October 10, 1934)

COPPER

	£	s.	d.
Standard cash	25	12	6
Three months	25	17	6
Electrolytic	28	5	0
Tough	27	10	0
Best selected	28	0	0
Sheets	56	0	0
India	38	15	0
Wire bars	29	0	0
Ingot bars	29	0	0
H.C. wire rods	31	15	0
Off. av. cash, September	27	11	6⅜
Do., 3 mths., September	27	17	6
Do., Sttlmnt., September	27	11	10½
Do., Electro, September	30	15	8¼
Do., B.S., September	30	13	1½
Do., wire bars, September	31	0	3
Solid drawn tubes			9½d.
Brazed tubes			9½d.
Wire			6d.

BRASS

Solid drawn tubes	8½d.
Brazed tubes	10½d.
Rods, drawn	8d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	6⅞d.
Wire	7d.
Rolled metal	6⅜d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	230	5	0
Three months	228	12	6
English	230	5	0
Bars	232	2	6
Straits	230	7	6
Australian (nom.)		—	
Eastern	229	7	6
Banca	232	0	0
Off. av. cash, September	230	0	0¾
Do., 3 mths., September	227	17	3
Do., Sttlmt., September	230	1	0

SPELTER

	£	s.	d.
Ordinary	11	15	0
Remelted	12	15	0
Hard	10	0	0
Electro 99.9	14	5	0
English	13	0	0
India	12	0	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., September	12	14	10⅞
Aver. spot, September	12	12	10½

LEAD

	£	s.	d.
Soft foreign ppt.	10	3	9
Empire (nom.)	11	1	3
English	12	5	0
Off. average, September	10	10	0
Average spot, September	10	7	9

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex-whse.	22	7	6
Rods	26	5	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	46	0	0	to	49	0	0
Chinese, ex-whse.					41	0	0
Crude						—	

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to	11	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	£8 17 6
45/50%	£13 0 0
75%	£18 7 6
Ferro-vanadium—	
35 50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	5/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	£29 15 0
4/6% car.	£23 0 0
6/8% car.	£21 12 6
8/10% car.	£21 12 6
Ferro-chrome—	
Max. 2% car.	£36 0 0
Max. 1% car.	£38 15 0
Max. 0.70% car.	£42 0 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅛ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£	s.	d.		£	s.	d.
Heavy steel					2	15	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to	2	11	0
Heavy cast iron	2	7	6	to	2	8	6
Good machinery					2	12	6
Cleveland—							
Heavy steel					2	10	0
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	10	0	to	2	12	6
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					2	17	6
Steel turnings, f.o.r.					1	13	0
Scotland—							
Heavy steel	2	10	0	to	2	11	6
Ordinary cast iron					2	11	3
Engineers' turnings					1	19	9
Cast-iron borings	1	19	0	to	2	0	0
Wrought-iron piling	2	10	0	to	2	11	3
Heavy machinery	2	14	0	to	2	15	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.		£	s.	d.
Copper (clean)					25	0	0
Brass					16	10	0
Lead (less usual draft)					9	10	0
Tea lead					7	0	0
Zinc					9	0	0
New aluminium cuttings					66	0	0
Braziery copper					22	0	0
Gunmetal					22	0	0
Hollow pewter					145	0	0
Shaped black pewter					110	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.				12	0	0	
Gas strip	10	10	0	and up.			
Bolts and nuts, ¾ in. × 4 in.				14	0	0	
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	8	0	0	to	8	10	0
Chequer plts.				10	7	6	
Angles				8	7	6	
Tees				9	7	6	
Joists				8	15	0	
Rounds and squares, 3 in. to 5½ in.				9	7	6	
Rounds under 3 in. to ½ in. (Untested)				8	12	0	
Flats—8 in. wide and over				8	12	6	
,, under 8 in. and over 5 in.				8	17	6	
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)				9	7	0	
Black sheets, 24g. (4-t. lots)				10	10	0	
Galv. cor. shts. (,,)				13	0	0	
Galv. flat shts. (,,)				13	10	0	
Galv. fencing wire, 8g. plain				14	10	0	
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	2	6	to	5	10	0
Tin bars	5	2	6	to	5	7	6

PHOSPHOR BRONZE

	Per lb. basis
Strip	8⅞d.
Sheet to 10 w.g.	9⅞d.
Wire	11½d.
Rods	9⅝d.
Tubes	12⅝d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7¼
To 15 in. wide	1/1½ to 1/7¼
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.25
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		18/2
,,	28×20 ,,		36/4
,,	20×10 ,,		26/- to 26/1½
,,	18¾×14 ,,		18/7½ to 18/9
C.W.	20×14 ,,		15/7½
,,	28×20 ,,		33/6 to 33/9
,,	20×10 ,,		22/9 to 23/-
,,	18¾×14 ,,		16/-

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Oct.	4 ..	25	13	9	dec. 12/6
,,	5 ..	25	16	3	inc. 2/6
,,	8 ..	25	18	9	,, 2/6
,,	9 ..	25	16	3	dec. 2/6
,,	10 ..	25	12	6	,, 3/9

Electrolytic Copper

		£	s.	d.	
Oct.	4 ..	28	10	0	dec. 20/-
,,	5 ..	28	10	0	No change
,,	8 ..	28	10	0	,, ,,
,,	9 ..	28	10	0	,, ,,
,,	10 ..	28	5	0	dec. 5/-

Standard Tin (cash)

		£	s.	d.	
Oct.	4 ..	230	0	0	dec. 25/-
,,	5 ..	230	15	0	inc. 15/-
,,	8 ..	230	10	0	dec. 5/-
,,	9 ..	230	15	0	inc. 5/-
,,	10 ..	230	5	0	dec. 10/-

Tin (English ingots)

		£	s.	d.	
Oct.	4 ..	230	0	0	dec. 30/-
,,	5 ..	231	0	0	inc. 20/-
,,	8 ..	230	10	0	dec. 10/-
,,	9 ..	230	15	0	inc. 5/-
,,	10 ..	230	5	0	dec. 10/-

Spelter (ordinary)

		£	s.	d.	
Oct.	4 ..	11	15	0	dec. 1/3
,,	5 ..	11	17	6	inc. 2/6
,,	8 ..	12	0	0	,, 2/6
,,	9 ..	12	0	0	No change
,,	10 ..	11	15	0	dec. 5/-

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Oct.	4 ..	14	7	6	dec. 2/6
,,	5 ..	14	10	0	inc. 2/6
,,	8 ..	14	10	0	No change
,,	9 ..	14	10	0	,, ,,
,,	10 ..	14	5	0	dec. 5/-

Zinc Sheets (English)

		£	s.	d.	
Oct.	4 ..	23	10	0	No change
,,	5 ..	23	10	0	,, ,,
,,	8 ..	23	10	0	,, ,,
,,	9 ..	23	10	0	,, ,,
,,	10 ..	23	10	0	,, ,,

Lead (English)

		£	s.	d.	
Oct.	4 ..	12	0	0	dec. 5/-
,,	5 ..	12	5	0	inc. 5/-
,,	8 ..	12	5	0	No change
,,	9 ..	12	5	0	,, ,,
,,	10 ..	12	5	0	,, ,,

A COMPARISON OF SCRAP PRICES

Prices of Heavy Steel Scrap (Delivered) in the Principal Districts at the Beginning of Each Month in the Years 1929–1934.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Scotland—													
1929	3 5 6	3 7 6	3 12 6	3 15 0	3 15 0	3 15 0	3 15 6	3 16 0	3 17 6	3 15 0	3 12 6	3 10 6	3 13 1½
1930	3 9 0	3 7 6	3 5 0	3 5 0	3 0 6	2 15 0	2 12 0	2 10 0	2 13 3	2 10 0	2 10 0	2 10 0	2 17 3¼
1931	2 7 6	2 7 6	2 5 0	2 5 0	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 15 0	2 0 0	2 2 6	2 1 0½
1932	2 2 6	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 15 0	1 15 0	1 12 6	1 13 0	1 12 6	1 15 0	1 16 9½
1933	1 15 0	1 17 6	1 18 6	1 18 9	1 18 0	1 17 6	1 18 9	2 0 0	2 2 6	2 5 0	2 7 6	2 8 9	2 0 7¾
1934	2 8 9	2 14 3	2 13 0	2 13 0	2 12 0	2 10 0	2 10 6	2 10 6	2 11 0	—	—	—	—
North-East Coast—													
1929	3 0 0	3 2 6	3 3 6	3 3 6	3 3 6	3 5 0	3 5 0	3 5 0	3 5 0	3 6 6	3 5 0	3 3 6	3 4 0
1930	3 3 6	3 3 6	3 2 0	3 0 0	2 17 6	2 10 0	2 10 0	2 7 6	2 7 6	2 7 6	2 5 0	2 6 0	2 13 4
1931	2 6 0	2 6 0	2 5 0	2 5 0	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 17 6	2 2 6	2 1 2½
1932	2 0 0	2 0 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 12 6	1 15 0	1 17 6	2 15 10
1933	2 0 0	2 0 0	2 5 0	2 0 0	1 15 0	1 17 6	2 2 6	2 2 6	2 3 6	2 5 0	2 7 6	2 7 6	2 2 2
1934	2 10 0	2 16 0	2 10 0	2 7 6	2 7 6	2 10 0	2 9 9	2 10 0	2 10 0	—	—	—	—
South Wales—													
1929	3 8 6	3 10 6	3 15 0	4 0 0	4 0 0	3 18 0	3 17 6	3 17 6	3 15 0	3 15 0	3 12 6	3 7 6	3 14 9
1930	3 7 6	3 6 0	3 6 0	3 4 0	3 2 6	2 17 6	2 16 0	2 15 0	2 14 9	2 12 6	2 12 6	2 5 0	2 18 3¼
1931	2 5 0	2 7 6	2 7 6	2 7 6	2 5 0	2 2 6	2 0 0	2 0 0	1 18 0	2 2 6	2 5 0	2 7 6	2 4 0
1932	2 6 6	2 6 0	2 5 0	2 2 6	2 2 0	1 19 0	1 17 6	1 18 6	1 18 0	1 18 0	1 17 6	1 18 0	2 0 8½
1933	2 0 0	2 1 6	2 4 0	2 3 6	2 3 6	2 3 0	2 5 0	2 5 0	2 8 0	2 10 0	2 10 0	2 10 0	2 5 3¼
1934	2 10 0	2 16 3	2 15 9	2 13 9	2 14 3	2 15 0	2 14 3	2 14 3	2 15 0	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

Notice

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

DRAUGHTSMAN and Estimator (23) desires change; 5 years secondary school, 6 years tech. college, 6 years general eng., national cert. school cert.; keen, trustworthy; moderate salary.—Write, Box 920, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

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